Computer-aided Analysis of Hydro-chemical Data Concerning Deposition of Waste in Carboniferous Strata

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ABSTRACT

All mine water analyses in the Rhine-Ruhr area have been collected. Out of these data a complete three-dimensional model of concentration interfaces has been designed. With the digital model SCOP isolines and cross-sections have been deducted and the concentration of different anions have been depicted.

INTRODUCITON

The evaluation of natural ground-water is very important for the deposition of waste in deep mines.

SAMPLING AND REGISTRATION OF DATA

To collect all available information on the chemical composition of ground-water in the investigation area, the records of the DeutscheMontanTechnologie and of different mines in this region are evaluated as well as water analyses from various publications. This information is supplied by our own analyses of mine water, published by the DeutscheMontanTechnologie and the Hygienical Institution. Pictures and plans of the mines and reports of the mine survey made it possible to locate the sampling points. The registration of these data of water analyses is carried out with the special program system CHEMDAT[(1)].

CHEMDAT is a system of dialog-oriented programs for main frames, especially for the processing of chemical water analyses. It comprises data base routines and the following additional features:

- Standardisation of different units
- Calculation of missing chemical values based on hydrochemical identities
- Establishment of ion balances and further mathematical calculations to control the analyses
- Branching into further programs (WATEQ4, WATSPEC) to calculate the species distribution of ions and mineral saturation coefficients

- Classification of the results of the analyses according to the limits of different standards
- Graphical presentation of the results in histograms, PIPER-diagrams and orbital diagrams.

DATA PROCESSING

For the evaluation it is important to distinguish between natural mine water and water which is used in the mine, for example, for cooling. This problem was solved by fixing lower and upper limiting values for the concentration of the main elements of the water. These values were fixed according to the depth Water analyses which do not lie within these limits are not taken for further calculation. If there is more than one analysis for a sampling point only the most up-to-date data are taken.

To create a clearly arranged presentation of the subsurface concentration distribution in ground-water, a complete three-dimensional model of concentration interfaces was designed. For calculation of these concentration interfaces of the contents of selected chemical constituents, the investigation area was divided by a rectangular equidistant grid into disjuncted squares. By means of statistical methods for each of those squares a mean level of the concentration interfaces was determined and fixed as the height of this area centre.

GRAPHICAL PRESENTATION

All concentration interfaces were calculated with the digital terrain model SCOP[2,3]. From these interfaces isolines and cross-sections were deducted.

SCOP is a dialog-oriented program system for main frames. Given the measured heights of some points of the model area it computes a complete surface according to the method of linear prediction based on rectangular griding. Moreover SCOP has the necessary post-processors to present the results graphically in isoline-plans and cross-sections. So the concentration interfaces of chloride-concentration of 10.000 mg/l and 50.000 mg/l were determined (Fig. 1).

CONCLUSION

All available hydrochemical data of the carboniferous layers and the overburden are registered and evaluated by CHEMDAT. The representation is carried out by the digital terrain model SCOP. The results of this model are presented in cross-sections, which show the distribution of ground-water chemistry in the strata of carboniferous layers and the overburden according to the depth.

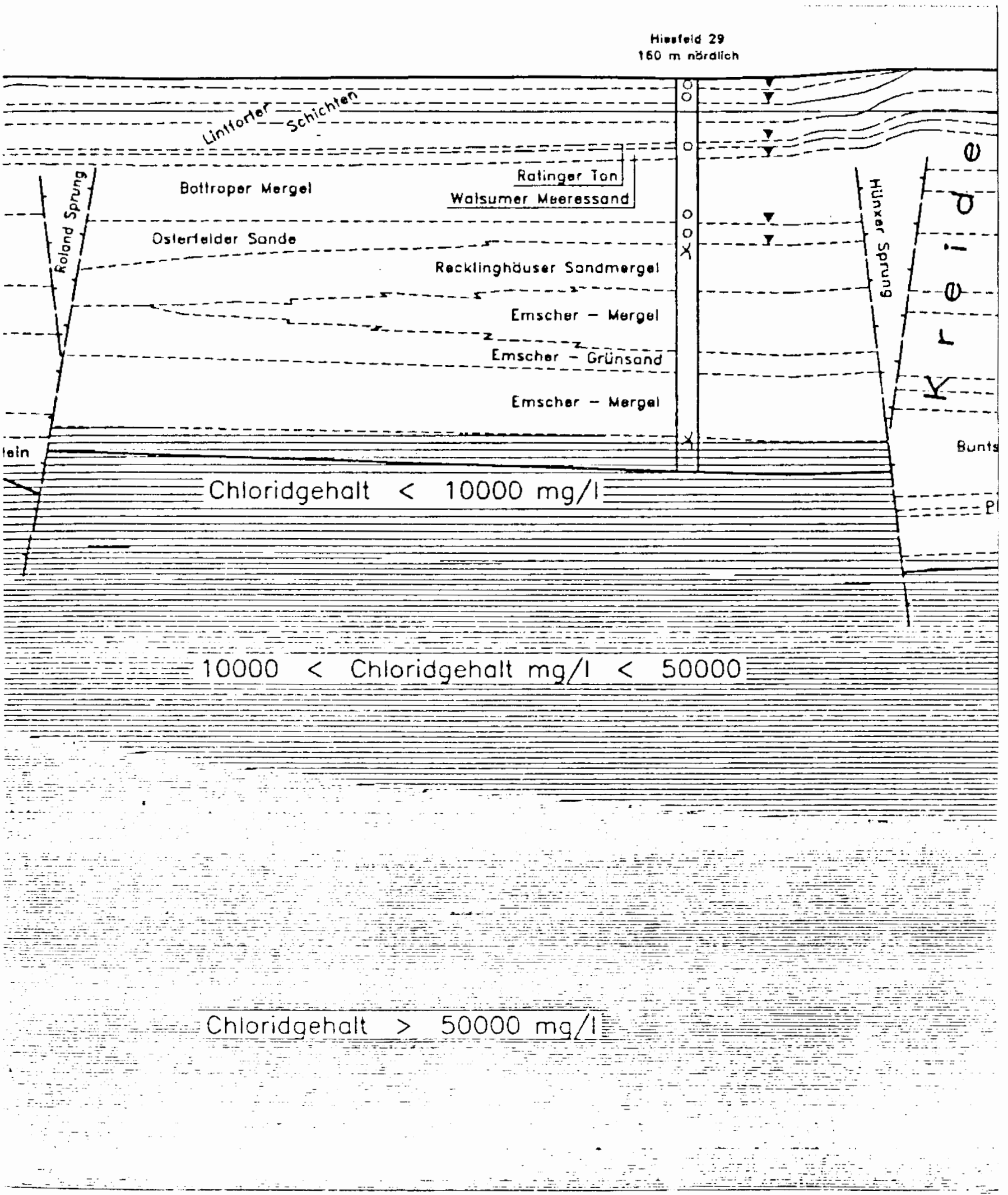

Figure 1: Chloride concentration on a cross section

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