

## CONFERENCE REVIEW

### HYDROGEOLOGICAL ASPECTS OF MINING

A meeting of the hydrogeological group of the Geological Society of London took place at the Department of Geological Sciences, University of Aston, Birmingham (U.K.) on 7th June 1983, to discuss hydrogeological aspects of mining. Some 80 people representing various organisations including coal mining industry, Institute of Geological Science, water authorities, cementation research; University mining, civil engineering, geology and hydrogeology departments, groundwater consultants and contractors attended the meeting. Altogether five papers encompassing a variety of subjects were discussed in this meeting. The topics of discussion were as follows :

- o Evaluation of hydrogeological parameters at new mine sites
- o Estimation of ground water inflow into a shaft
- o Hydrochemistry of British Coal Measures
- o Factors affecting the decision for grouting or freezing
- o Origin and disposal of ferruginous mine water.

A paper on the hydrogeological investigation of new mine sites outlined the philosophy of the National Coal Board with regard to mine water control, which is one of exclusion rather than pumping. The principal techniques of site investigation developed by the National Coal Board for the detailed evaluation of a major shaft sinking or drift drive operation were discussed. These techniques and their interpretations were aimed at predicting the quality and quantity of ground water inflow and providing the basic hydrogeological data essential for the lining design and selection of an efficient method of ground treatment.

Dr. Lloyd and Dr. Rushton described the method of hydrogeological assessment in a multi-layer permeable ground using a packer testing technique. Difficulties encountered in installing packers in caving boreholes in weak host rock were described together with the eventual use of oil industry drill stem test technique to obtain reliable permeability values. A permeability assessment was carried out using various weighing techniques to provide a complete vertical distribution on which analogue models of potential inflow were based. The analogue models permitted a detailed prediction of the flow patterns around both the proposed shaft and drift which eventually assisted in taking the final investment decision.

Mr. Harris and Dr. Pollard discussed a paper on factor affecting grouting or ground freezing decision. When the yield is small, the water in excess of 4 g/s can be dealt with by pumping. However, as the yield increases it becomes necessary to deal with the potential inflow by preventive measures. Two of the methods commonly employed in mining to facilitate excavation in wet/or weak ground conditions, are artificial ground freezing and grouting. The decision whether such an aid is needed, and if so which method is most appropriate, is based on the local hydrogeology. This is obtained from core drilling, borehole water yield and/or acceptance tests, geophysical logging and laboratory tests. For a ground freezing technique to be successful the natural

water content of rock mass should be at least 11%. The increase in rock mass strength is a function of ice/water content and the extent of temperature reduction below freezing point. Cement and chemical grouts become more expensive with the fineness of pore spaces, i.e. with reduced natural permeability. Injection methods are impractical for ground permeability values less than about  $10^{-6}$  m/s.

Mr. A. G. Glover, of National Coal Board, discussed the application of hydrochemistry of the British Coal Measures in evaluating the origin of mine water. The undisturbed Coal Measure strata are almost invariably saturated with water. The concentrations of dissolved salts (chlorides) in these aquifers increase with depth and the relative concentrations of various ions conform to systematic quality patterns, apparently defined by geochemical constraints. The principal salts are sodium, calcium and magnesium chlorides in the deeper confined aquifers, sodium bicarbonate in the shallow confined aquifers and calcium and magnesium sulphates in the unconfined aquifers. The practical value of this information to the mining industry together with possible geochemical mechanisms for observed water quality patterns were discussed.

In a paper on the origin and disposal of Ferruginous mine water, the speaker Mrs. Henton, gave the views of the water industry on the water pollution problems. The effects of mining on natural hydrogeological regimes are on the surface hydrology and hydrogeology of the affected area together with the water quality of both surface and underground water. The entire cycle of mining from the start of dewatering to the end of ground water rebound after completion of mining operations affects the natural regimes in different ways at various stages. An attempt was made to illustrate these effects together with the problems associated with the disposal of ferruginous water. The legislative controls over pumped water were also briefly described.

Each of the papers were followed up by interesting discussions. The full text of the papers will be published in a future issue of the Quarterly Journal of Engineering Geology.

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