GROUTING OF POROUS AQUIFERS
DURING SHAFT SINKING
Ju. A. Polozov*, I. V. Popov**
* C.Sc. Min.Eng., Vice Director General
** Deputy Principal
Specialized Association Spetstamponazhgeologia,
7a Petrovski St., Antratsit,
Voroshilovgrad Region, USSR.

ABSTRACT
The paper describes a new advanced grouting technique for porous aquifers using clay-cement grouts during shaft sinking. This technique is characterized by creating in a porous water bearing strata a network of artificial, interconnected fractures employing hydrofracturing with subsequent grout injection.

INTRODUCTION
Domestic and foreign mine construction experience indicates that water inflow shut-off during shaft sinking in porous aquifers presents a serious problem. The conventional cementation technique would fail in achieving the needed results because the grout, as a rule, does not penetrate into pores either due to the bigger size of cement particles or due to infiltration of a liquid phase from the cementitious suspension that results in formation of cement plugged zone around the injection hole.

The application of the chemical grouting technique at great depths is in the design stage and has not been applied on an industrial scale. The freezing technique gives positive results but it is extremely costly and requires much time both for carrying out freezing operations and for subsequent tubbing lining.

Imperfection of special techniques for porous rocks results in considerable residual water inflows, as has been observed, for example, during shaft sinking at the Krasnoarmeyskaya-Kapitalnaya, Gorskaya, Cheluskintsev, Jużhnomołodziskaya and some other mines in Donbass, USSR. The residual inflows in the shafts at these mines achieved 15-90 m³/hr.

Complexity of the water shut-off problem during shaft sinking in fissured-porous and porous strata calls for developing effective grouting techniques based on principally new technological processes of strata sealing together with new grouting schemes.
Sealing barrier formation around shafts in the intervals of water bearing zones has been carried out according to the scheme which envisages creation of a intersecting system of artificial cracks by means of hydrofracturing technique through the holes drilled from the surface, and filling them under pressure with the grout (Fig. 1).

The process of sealing barrier formation around a shaft requires implementation of the following technological patterns and operations:

- Calculations, utilizing special methods, of sealing barrier formation parameters comprising the length and development value of hydrofracturing and hydrowidening artificial cracks, the required quantity of hydro-sand-jet perforation channels, the number of injection points and grout holes. These calculations are based on the physical-mechanical properties of rocks, bedding depth of an aquifer, strata water pressure heads etc.

Figure 1. Sealing barrier formation scheme around a shaft in porous rocks

1 - Mine shaft, 2 - Grout hole, 3 - Hydro-sand-jet perforation channels, 4 - Artificial cracks
5, 6, 7, 8, 9, 10, 11, 12 - Numbers of boreholes