This paper reports on mathematical models of rock media processing and on their use in designing open pit coal mines. Spatial mathematical model of rock media was processed on a 25 km² model site, incorporating 918 borehole logs. The model is capable of providing information concerning the geological structure of every point of the investigated area by plotting geological cross-sections along given lines or by plotting contour lines of the surface or the base for thickness of chosen lithological strata. The computation of one point of a grid involves the following steps: Borehole logs are numerically coded. The geological structure at an arbitrarily chosen point P is computed as follows. All borehole logs inside the circle (P; R) are used to compute the Z-coordinate of the ground at P by some interpolation formula chosen from those contained in the program system. Next, we check what stratum occurs topmost at boreholes inside the circle and which is most probable as the top stratum C₁ at P. The Z-coordinate of the C₁ stratum surface at P is computed. Then what strata occur under C₁ stratum and which of them is the most probable stratum C₂ is determined. The process of computation is repeated until a sequence of strata C₁ at P and Z, coordinates of their surfaces is ascertained. The interpolation formulas included in the system are proper linear combination of PAF (polynomial approximations formulas, linear or quadratic and weighted) and WAF (weighted average formulas). Among the various interpolation formulas, some proved more useful for tectonic fault lines, others for ordinary sedimentary surfaces.

KEY WORDS: geological cross-sections, contour lines, ordering algorithm, interpolation formulas, computer programs.

INTRODUCTION

Models discussed here start from data obtained (mainly) through borehole logs of variable depth scattered irregularly in the investigated area. Among the data for each borehole log are, of principal importance: spatial coordinates of the location, codes describing various lithological units at each location, and boundaries of these strata. For the purpose of designing the mathematical models, the various kinds of lithological strata, if too many and too detailed, are preferably grouped together by the model user into complex of strata called the groups in what follows. After establishing groups which is just a simple,

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1Charles University Prague, Czechoslovakia.
2Stavební Geologie Prague, Czechoslovakia.
but often an important, adaptation of the original list of strata, a data basis is obtained and this becomes the starting point of subsequent mathematical analysis.

This treatment should be thoroughly automatic and performed by a computer. The model should be capable of providing information concerning the geological structure of the investigated area or any of its parts. It should be able to issue such information by giving the corresponding numerical values at every point in the area by plotting geological cross-sections along given lines or by plotting contour lines of the surface, or of the base of an arbitrarily chosen lithological group. Although values provided by the model are understood to be merely estimates of unknown real values, the reliability of the model should answer the purpose intended. It should be comparable with the reliability of human analysis (the hand-made models) which, because of the enormous laboriousness and vast time they require, obviously are to be eliminated.

The authors are not aware of any mathematical model of this type in the literature. Attempts to manage the problem with several single-surface models computed successively and finally put together failed. The problem is mainly that of proper organization of the necessary calculation (i.e., a proper algorithm). In addition, consideration of what degree of accuracy can be achieved by what means and at what price is of great importance.

**ORDERING ALGORITHM**

The algorithm designed and tested on a real data basis has, in general, the following steps. It serves to provide information concerning the geological structure at an arbitrarily chosen point \( P \) in the investigated area.

1. Given a radius \( R \) beforehand (see Remark 1), the \( Z \)-coordinates (mostly elevations above sea level) of all boreholes inside the circle \( (P; R) \) are considered; the \( Z \)-coordinate of the ground at \( P \) is computed by some interpolation formula which has been chosen beforehand from those contained in the system (see Remark 2). At the same time, what groups occur as top strata at each borehole and which of them is most probable to occur as the top group at \( P \) (see Remark 4) is determined. This is group \( C_1 \), selected for the next step.

2. Considering all boreholes inside circle \( (P; R) \), the first appearance of \( C_1 \) at every borehole is determined. Again, by the interpolation formula which has been chosen beforehand, the \( Z \)-coordinate of the \( C_1 \) stratum surface at \( P \) is computed. Then, the indicated \( C_1 \) strata in all boreholes and also all strata above them, if any, are removed. By considering what groups occur beneath the removed \( C_1 \) strata in each borehole, the most probable group next to \( C_1 \) at \( P \) is determined. This will be group \( C_2 \), selected for the next step.