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# Numerical Simulation Analysis of Collapse Column Direct Current Method

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**Abstract** Karst collapse column, a geologic abnormal body, often can be seen in the mine of production and construction. Especially water of collapse may cause disastrous consequences without proper settlement. Considering this problem, we must sufficiently evaluate the geological conditions, collapse column form distributions, full evaluation and water enrichment, so as to provide the scientific basis for the controlment of abnormal body. This paper, on the basis of analyzation of the essential features of collapse column and relevant electrical parameters, puts forward a method of adapting the parallel electric technology to detect the collapse column, referring to the research achievements of predecessors of collapse column .To verify the feasibility of this method, the numerical simulation method is used mainly for roadway floor, front and working area of the roadway and collapse column on electrical characteristics simulation experiment, analyzing the electrical response characteristics under the different observation systems.
**Keywords** direct current electric method, collapse column, numerical simulation model

## Collapse column below the floor of roadway

In order to make the model of image close to the fact, different rectangular module is set to simulate low resistivity body. At underground of 10.5 m, initial width is 12 m, bottom width 32 m,the low resistance of abnormal body is set for simulation. We set 100 Ω·m to simulate the background of the surrounding rock resistance, 10 Ω·m to simulate the rich water of collapse column with 64 electrode in the interval by 2 meter.

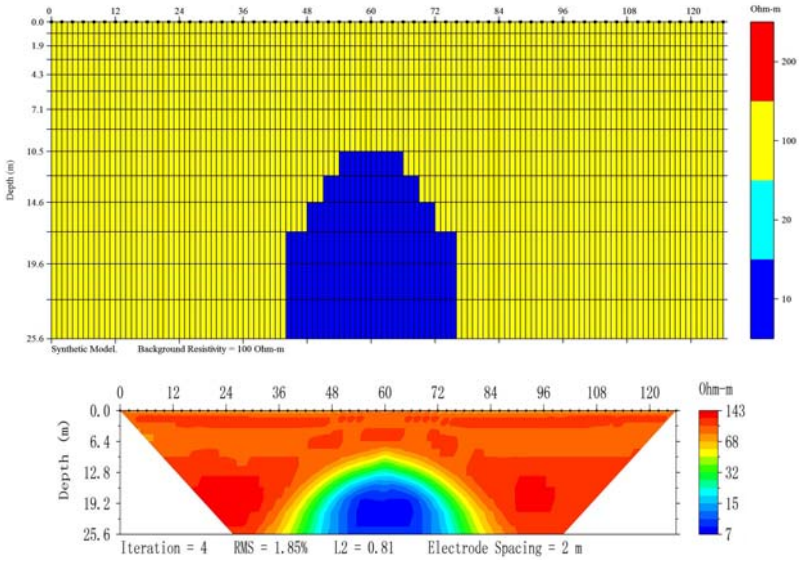


***Fig. 1*** *The model collapse column below the floor of roadway and result of numerical simulation*

As the version profiles shows, the background resistivity regional distribution is from 0 to 8 m on the vertical, 8 to14 m for high and low resistance transition belt and the relatively

resistivity zone is 14 to 26 m;48~72 m for low resistivity zone in horizontal direction. In conclusion, by the arrangement of dipole, the direct current electric method can reflect the rich water low resistance of collapse column position. Despite the boundary expansion effect, it is proved to be basically consistent with the preset model.

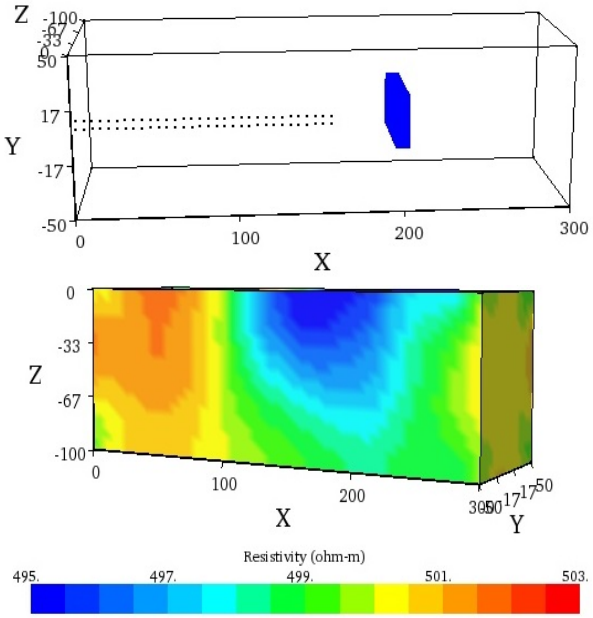


***Fig. 2*** *The model collapse column in front of roadway model and result of numerical simulation*

## Collapse column in front of roadway model

Inversion results show that the x axis has a low resistance regional anomaly above 200 m, more than 50 m, with the actual model design of low resistance position are very similar. In order to see more images of the distribution of abnormal body lead, extract 200 m ahead of slice figure, as can be seen from the figure on the location of the abnormal body slice and form with the model fit. Using"U" shape 3d advanced exploratory system to achieve the desired effect.

## Collapse column in working face model

As the three dimensional section of level 0 m section shows that the center has a low resistance reaction, which is below the low resistance of collapse column; In -45 m location slice, there are an obvious anomaly area and differences of the surrounding rock mass; In -63 m, because there are differences between the two low resistance body surface area, the response anomaly area bigger slice. Different depth slices, present regular "halo", framed in the area of abnormality. It is worth noting that the CT technology electrical method used to detect depth has a precise range, such as the abnormal position of slice depth -188 m area is not very obvious. In a word, you can see changes in the form.

## Conclusion

According to the spatial relations among collapse column and the known roadway: conditions, including collapsing column at the bottom of the roadway floor, in front of roadway and face internal, we carry out the numerical simulation of the performance which coincides with the initial setup model. Solution proves that effectiveness of the direct current

electric method possesses the unique effectiveness as well as flexibility in detecting collapse column.

Considering the complex geological environment of mine, there might be some discrepancies in the shape, depth and accuracy of collapse column between the actual situation and the statistics. Therefore, other means such as drilling are needed for further test and verification.

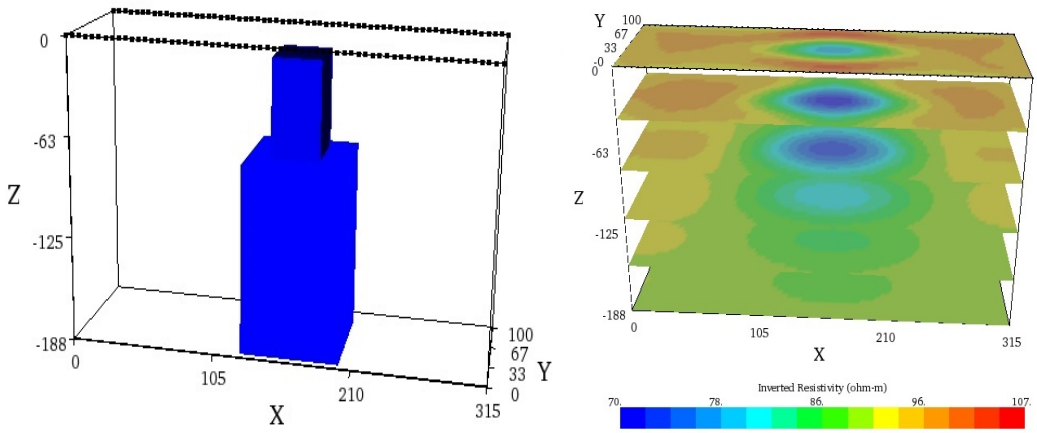


***Fig. 3*** *The model collapse column into working face and result of numerical simulation*