Application of soil radon measurement method in the exploration of sandstone type uranium deposits

Li Yang [a], Liyang Zeng, Gang Zhang

Chengdu Univerisity of Technology, Sichuan Chengdu 610059, China

[a] corresponding author: Yang Li Email:1124390551@qq.com

Abstract

This paper has completed work that was measuring soil radon of two sandstone type uranium deposits' exploration foreground areas of in Xiao Saishenteng Mountain and Qige Spring of Qaidam Basin using method of soil radon measurement. According to results of measured, a comprehensive chart of the concentration of radon concentration in two working areas was plotted. Based on the geological metallogenic conditions in the northern margin of Qaidam Basin, this paper points out the favorable direction of prospecting in those areas and set the course for the next step.

Keywords

The method of soil radon measurement; Xiao Saishenteng Mountain in Qaidam Basin; Qige Spring; chart of radon concentration distribution comprehensive.

1. Introduction

As a method of Radioactive geophysical prospecting, Soil radon measurement is an effective means of Exploration of deep concealed uranium deposits[1,2]. It is known to detect up to 500 meters in depth. In addition, it has been applied in gold exploration, earthquake prediction, oil and gas exploration and fault location[3,4].

This paper has measured two sandstone type uranium deposits' exploration foreground areas (work area of Xiao Saishenteng Mountain and Qige Spring) in northern Qinghai region of Qaidam Basin using method of soil radon measurement. Based on the measurement of soil radon，this paper has evaluated the exploration effect of soil test radon instrument and technology of soil radon measurement on sandstone type uranium deposits. At the same time, it has pointed out the working direction of the two uranium exploration prospect areas.

2. Work arrangement

Based on national standard and soil radon measurement standard, we do work arrangement in work areas of Xiao Saishenteng Mountain and Qige Spring. The actual measurement of radon in Xiao Saishenteng Mountain is 902 points. It covers an area of 44 km^2. Network density is 500 m * 100 m. And the measuring line is in the southwest of 210^o. The actual measurement of radon in Qige Spring is 942 points. It covers an area of 92 km^2. Network density is 500 m * 200 m. And the measuring line is in the north. The arrangement of the measuring line is shown in Fig. 1.

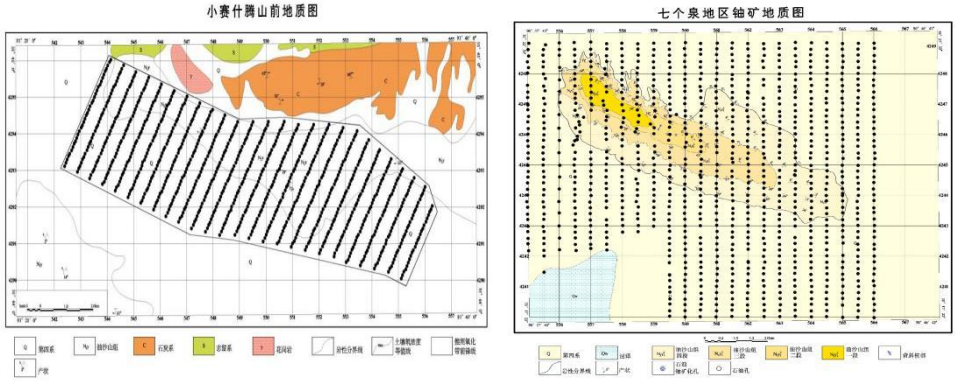

Fig. 1 The arrangement chart of two work areas

3. Data processing

In the original measurements' data, Xiao Saishenteng Mountain's maximum concentration of radon is 11900 Bq/m3, minimum is 816.5 Bq/m3, average is 4584 Bq/m3, standard deviation is 2438.5 Bq/m3, and coefficient of variation is 0.53. By ascertaining the range of abnormal halo, high halo and on the high side halo, this paper adopts method for gradually eliminating raw radon concentration data. Setting the lower bound for data elimination is the average plus three times the standard deviation. When the data are processed, the Xiao Saishenteng Mountain's background value of radon concentration is 4584 Bq/m^3, lower bound value of abnormal halo is 11898 Bq/m^3, and abnormal contrast is 2.60. Based on the processed data, we drawn a comprehensive chart about the concentration distribution of radon concentration in the soil in Xiao Saishenteng Mountain by software "MapGis", as shown in Fig. 2.

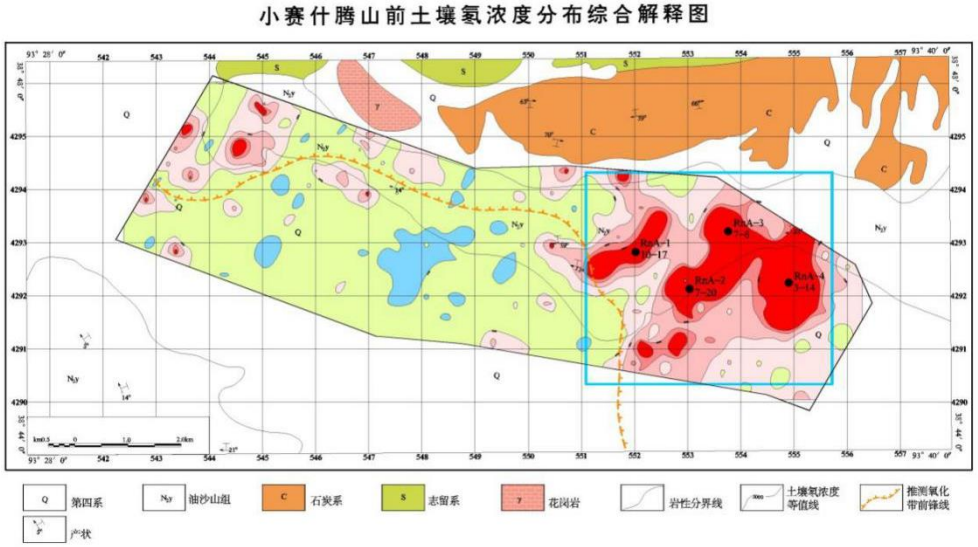

Fig.2 The comprehensive concentration distribution of soil radon in the work area of Xiao Saishenteng Mountain

Combined with geological structure of Xiaosaishenteng Mountain for comprehensive analysis, the high concentration of radon in soil are located in the northeast of the upper front of the presumed oxidation front zone. Contrasting stratigraphic distribution, the high concentration areas of radon in soil are mainly distributed in the interface between the third oil sand mountain formation (N_2y) and the Quaternary sedimentary layer (Q), and extend the interface evolution between the third system oil sand mountain formation and the Quaternary sedimentary strata. Contrasting the principle of abnormal radon concentration in sandstone type, because of the good radon migration channel at the interface of the formation, the radon anomaly areas are formed on the ground surface. Therefore, it can be considered that the advantageous formation of uranium mineralization in the region is mainly in the formation of tertiary oil sands mountain formation (N_2y), the focus of uranium exploration in

the work area should be in the blue box of Fig.2. And combined with the formation of third formation oil sand mountain formation (N_2y), we set Check points in other proper locations to avoid omissions. In the original measurements' data, Qige Spring's maximum concentration of radon is 15250 Bq/m^3,minimum is 914.5 Bq/m^3, average is 7011Bq/m^3, background value of radon concentration is 7011Bq/m^3， lower bound value of abnormal halo is 15492 Bq/m^3， and abnormal contrast is 2.21. We drawn a comprehensive chart about the concentration distribution of radon concentration in the soil in Qige Spring by software , as shown in Fig. 3.

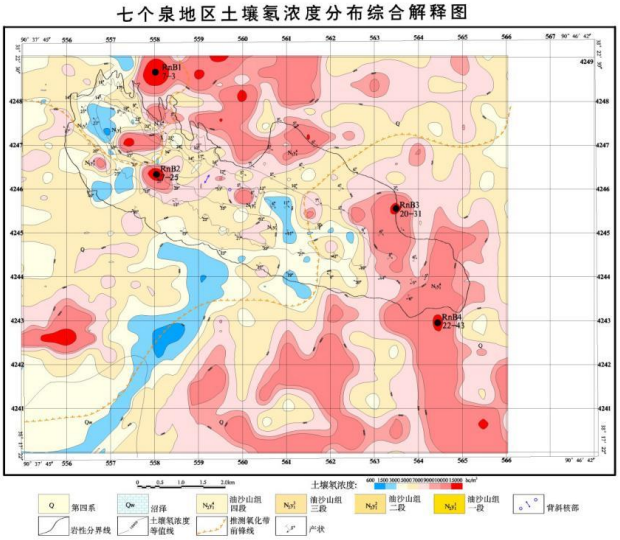

Fig.3 The comprehensive concentration distribution of soil radon in the work area of Qige Spring

Combined with geological structure of Qige Spring for comprehensive analysis, there are Four points of soil radon abnormal concentration, except RnB2 point , is located in the tertiary oil sands mountain formation (N_2y) exposed center position, other radon anomaly points divide actually tertiary oil sands mountain formation (N_2y) and quaternary sediments (Q) near the interface. According to soil radon measurement results, the focus of the subsequent sandstone-type uranium exploration should be placed in the northern and eastern part of the workspace (N_2y) and the fourth layer (Q) interface area, eastern tertiary oil sands mountain formation (N_2y) have a large sandstone type uranium ore prospecting prospect.

4. Conclusion

Using method of soil radon measurement, this paper has carried out practical application in verification area of two sandstone uranium deposits on the northern margin of Qaidam Basin in Qinghai(work areas of XiaoSaishiteng Mountain and Qige Spring).Based on the results of the soil radon measurement, we circled the abnormal points and their ranges in work areas. Combined with geological conditions, we explained and evaluated the results of uranium exploration in work areas, and pointed out the direction for the next step of work areas' exploration.

References

[1] Ngachin M, Garavaglia M, Giovani C, et al. Radioactivity level and soil radon measurement of a volcanic area in Cameroon.[J]. Journal of Environmental Radioactivity, 2008, 99(7):1056-1060.
[2] Zhao G Z, Xiao D T. Study on radon concentration measurement in soil[J]. Nuclear Electronics & Detection Technology, 2007, 27(3):583-587.
[3] Wang Z. Preliminary Application of Soil Radon Measurement Method in Active Fault Survey in Haikou City[J]. South China Journal of Seismology, 2006, 26(4):61-66.
[4] Wang Q, Wang H, Chen Y. APPLICATION OF SOIL RADON MEASUREMENT IN URBAN FAULT SURVEYING[J]. Journal of Geodesy & Geodynamics, 2010, 30(1):38-42.