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Study on Deep Uranium Information of Radon Anomaly Extraction Technology

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Each measuring point data of soil radon concentration is the result of superposition of radon space information. The soil radon gas made up of two parts, one is the native radon gas, from the uranium disintegration series, such as $^{238}\text{U} \dots ^{238}\text{Ra}$ within soil. And the other is the migrated radon or the radon produced from the migrated decay chain of uranium, including migrated nuclides from deep uranium deposit or surface. Vertical transport of the nuclides from deep uranium deposits are influenced by pressure, temperature and geological environment of cap rocks over deep uranium deposit, and so on. The nuclides transport with surface runoff was greatly impacted by the characteristics of surface landscapes. So the key technology of radon survey applied on deep uranium deposits exploration is how to extract the deep uranium information of radon anomaly.

1 Contrast Value or Numeric Difference Method

To process data of soil radon concentration by contrast value or numeric difference method will separate all anomalies and it will be beneficial to interpretation and inference. Under the same geological conditions, the average value of soil radon survey reflects the radon decay from radionuclide of soil, and the radon decay of radionuclide migrated from deep uranium deposits is overlay anomaly information. Compared with the original figure (Fig.1), the anomaly information of radon is clearly displayed by contrast value. As can be seen from the data contour, there are two beaded linear lining anomalies, which are associated with dual ore-controlling structure, the sandstone type uranium deposit buried over the depth of 100 m was found near the ore-controlling structure.

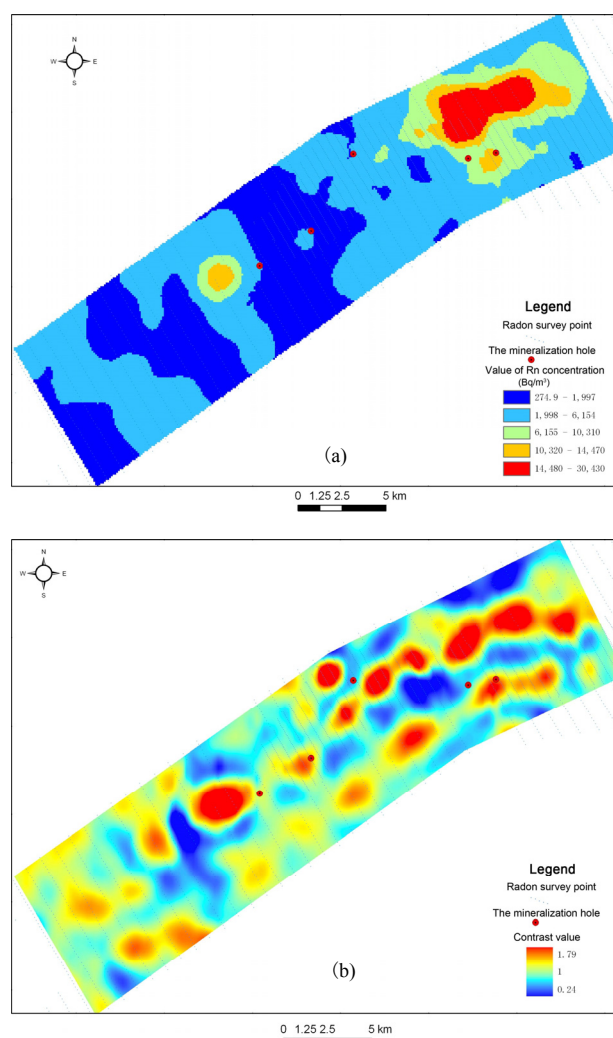


Fig.1. Contour for (a) raw data of soil radon concentration and (b) contrast value.

2 Radon Anomaly Separation Using Fractal Filtering Technique

Fractal filtering technique can separate the anomaly and background of soil radon (Cheng et al., 1994), and

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effectively extract deep information of uranium anomaly, which including three steps. First, transform the radon survey data into Spectral density space by Fourier transform. Second, selecting the appropriate filter to remove the background value, and then reconstruct the data by inverse Fourier transformation.

Spectral density (S) and the area of spectral density space which is greater than the spectral density(s) in double logarithmic diagram show the linear relationship, and different line segment represents the different fractal relations, significant anomaly information can be extracted by designing a low-pass spectrum filter.

As can be seen from the data of radon concentration contour after being produced by fractal technique (Fig.2), there are some beads or linear anomalies over the sandstone type uranium deposit buried over the depth of 120 m.

3 Radon and Calculated Radon Ratio Method

The value of uranium content by gamma spectrometry survey show mostly the shallow uranium information, and the background value of soil radon reflect the shallow uranium information, that is to say, uranium content of gamma energy spectrum and the background value of soil radon concentration is linear relationship. So, the radon concentration calculated by uranium content by gamma spectrometry survey can reflect the features of shallow radon concentration distribution information, in this way, using the ratio of the measured radon and calculated radon concentration to evaluate deep of radon anomaly information is an effective method.

References

Cheng Q ,Agterberg, F.P., and Ballantyne, S. B.,1994.The separation of geochemical anomalies from background by fractal methods. Journal of Exploration Geochemistry,51 (2):109-130.

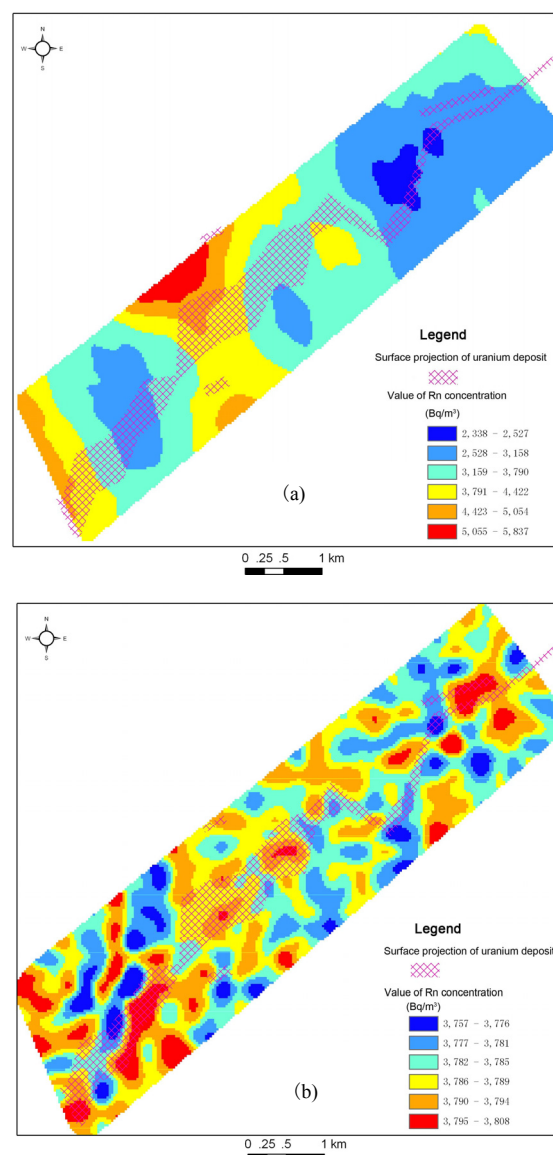


Fig.2. Soil radon concentration contour for (a) raw data and (b) processed by fractal filtering technique.