RADON ANOMALY AND ROCK SLIDE PREDICTION

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ABSTRACT

In order to explore whether radon anomaly could be considered the precursor of rock slide, the forming mechanism of the radon anomaly is qualitatively analysed according to the relationship between rock rupture and radon content. It is indicated that the rock microfracture may be one of the reasons leading to the radon anomaly before rock slide, suggesting that the CR-39 solid state nuclear track detector could be used to monitor the radon concentration in the region of the slide. The information may then be used to predict rock slide.

Keywords: Radon anomaly Rock slide prediction Alpha track method

1 INTRODUCTION

During the deformative process, the slide will produce various cracks on the ground of the slide region, the author thinks that some microfractures will be produced in the interior of the slide region. It is very important for the rock slide prediction accurately to get the information of these microfractures and analyse their changes with time. According to the experimental results of relationship between the rock rupture and change of the radon content, after analysing the microfractures formed in the deformative process, the author believes that these microfractures are one of the reasons why there are anomalous radon values before any rock slide. The advanced CR-39 solid state nuclear track detector (SSNTD) is one of the best techniques for predicting rock slide.

2 FORMING MECHANISM OF RADON ANOMALY

Because ^{238}U, ^{232}Th and other natural radioactive nuclides exist in the rock, the radioactive gases of the radon and its progeny are produced around the rock. The concentration of radon emanation relates to rock structure, rock microfracture produced by the pressure, the area of internal surface and so on. Based on the previous experiments[1], the concentration of the radon fluctuates around an average value when there is no pressure exerted upon the granite specimen. Inversely, when a pressure is exerted, the granite specimen is gradually ruptured, the measuring results

show that the radon concentration increases obviously and continually at first, then fluctuates around a higher value, as shown in Fig.1.

The radon concentration will return to the original value when the cracks are filled up, as shown in Fig.2.

The experimental results indicate that the increase of radon concentration directly relates to the deformative process of the granite specimen.

When the differential stress exceeds a certain value, the rock will be destructed. According to conventional triaxial experiment of the rock mechanism[2], when the differential stress reaches about half of the strength of the rock, the volume of the rock specimen will begin to enlarge inelastically, and so, "expansion" takes place.

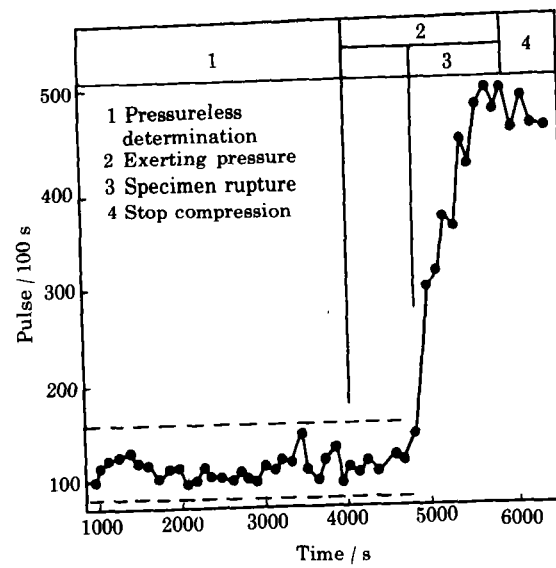

Fig.1 Radon value curve before and after press cracking of the granite specimen

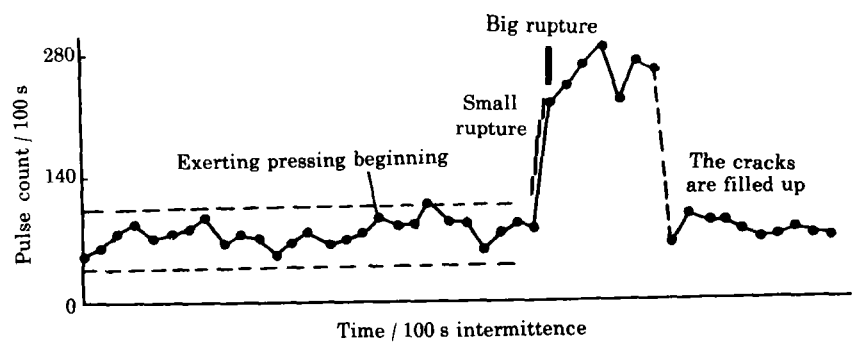

Fig.2 Radon value curve of the granite specimen in the press cracking process and after the cracks are closed

During the deformative process of rock slide, the shearing stress will be increased when the equilibrium of driving force and resisting force is broken. Some microfractures will be produced in the interior of slide block and between the slide block and the bottom bed, the "expansion" phenomenon of the slide block will appear. The radon will move upwards to the ground surface along the microfractures by diffusion, convection, terrestrial heat and so on, which causes radon anomaly.

If the rupture of the rock with enough strength is considered as the rock slide, the anomaly of radon content produced by the microfracture could be considered as the precursor phenomenon before rock slide.

3 PRINCIPLE AND SCHEME OF ROCK SLIDE PREDICTION

3.1 The principle of rock slide prediction

Radon isotope and radon progeny are mainly alpha emitters. The author thinks that CR-39 SSNTD is an ideal detector for alpha particles, prepared by polymerizing the liquid monomer allyl diglycol carbonate (ADC) and the initiator bengoyl peroxide (BPO), a kind of passive detector highly sensitive to alpha particles. By monitoring the anomaly of the radon concentration in slide region with CR-39 SSNTD, the information for rock slide prediction can be obtained.

3.2 The scheme about predicting the scale of rock slide

In order to predict the scale of rock slide using the radon anomaly in slide region, detecting holes should be drilled in middle part and upper part of the slopes at possible slide regions. At the same time, the drilling holes could be selected in different depths. By analyzing the radon anomaly distribution, the length and depth of the slide block, i.e. the slide scale, can be estimated. The large-scale slide of Ya Long Jiang in China lasted from 1960 to 1967 would have been predicted if the CR-39 SSNTD radon anomaly detection technique had been used.

4 CONCLUSION

a. Some microfractures may be formed during the deformative process. They provide the condition for the radon gas under the terrain to move upwards, so it is possible to predict the rock slide through monitoring the change of radon concentration in slide region using CR-39 SSNTD.

b. CR-39 SSNTD is a kind of passive detector. As compared with other installations of slide prediction, it has the advantages of economy, simplicity, high sensitivity, high resolution and so on. CR-39 SSNTD is an ideal detector for light particles, all the alpha particles in nature can be recorded on it, therefore it could be used in predicting short-term, middle-term or long-term slides.

c. A series of CR-39 SSNTD are to be arranged in the hinterland of Xuefeng mountain near Dongping town of Anhua county for a period of about four weeks, in an attempt to predict the slides in that region.

REFERENCES

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