The geological disposal research of high-level radioactive waste in China

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Recently, with the impressive economic boom and development of technology in China, energy shortage has become a more and more serious problem. Nuclear energy is considered as one of the alternative solutions. Obviously, the issue on nuclear waste disposal becomes important actuality.

This article put forward that China has adopted an elementary technology route for the geological disposal of high-level radioactive waste which includes three stages: siting and site characterization, underground research laboratory for a site-specific, and repository. The objectives are the completion of Chinese high-level radioactive waste geologic repository around 2030-2040 [1-2]. The disposed waste are vitrified high-level waste, transuranie waste and some spent fuel. The repository is shaft-tunnel-type, located in the saturated zone [3-4]. The Beishan area in Gansu Province is thought to be the most appropriate area because of its Gobi desert location, stable crust and rare inhabitants as well as its good geological and hydro-geological condition [5]. For the repository bentonite is chosen to use as a kind of backfill. A large amount of deep geological data, adsorption and diffusion, associated with radioactive-nuclides' transportation in granite and bentonite [6]. The devices used to simulate temperature, pressure and redox condition of the repository have also been established [7]. Studies on siting evaluation, geochemical behavior of radioactive nuclides, buffer material, and environment impact assessment are being carried out in depth. The cooperation with the international Atomic Energy Agency have been very fruitful [8].

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Phosphate nodules from the lower Cambrian Niutitang Formation black shale in Yangtze block, NW Hunan province, China: Implication for early diagenetic processes

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Phosphate nodules are widely distributed in early Cambrian black shale sequence in Yangtze block, south China. In this study, we sampled phosphate nodules of various size from two PC-C sections from Hunan province and analyzed redox-sensitive trace elements, rare earth elements, and Sr isotopic compositions of both the nodules and host black shales from the Niutitang Formation of Lower Cambrian stata in northwest Hunan province.

The results show that the phosphate nodules show symmetry in geochemistry which imply the core-rim growth pattern of phosphate nodules. Bigger nodules show seawater-like shale-normalized REE patterns, which may represent the characteristics of pore fluids during very early diagenetic stage; whereas those smaller nodules show MREE-rich patterns, which should represent a typical feature of diagenetic pore fluids in the organic-rich sediments. Ce anomaly in the phosphate nodules reveals a gradually reduced environment during the process of early diagenesis. Weak positive Eu anomaly and high U/Th ratios in some nodules may suggest involvement of hydrothermal fluids during nodule formation process, which is in line with the hydrothermal model proposed by many researchers for the Ni-Mo polymetallic sulfide marker bed just above the phosphate nodule riched black shale layer in the same area [1-3]. Higher than coeval seawater $^{87}Sr/^{86}Sr$ ratios (0.71028-0.71251) of the phosphate nodules indicate a radiogenic Sr contribution from the host organic-rich mudstone, possibly during diagenetic processes.

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