Baseline characterization of surface water at the Coles Hill uranium deposit, Virginia

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Increasing interest in uranium deposits in temperate locales such as Virginia requires a reassessment of existing characterization methods. The goal of a pre-operational baseline characterization is to provide data which will enable both the identification of potential environmental impacts during mining and the establishment of post-mining closure targets.

A baseline surface water characterization study has been conducted at the undeveloped Coles Hill uranium deposit in agricultural Pittsylvania County, southern Virginia, USA. The study area included locations in stream reaches and ponds both upgradient and downgradient of potential mining, milling, and storage sites within the footprint of the deposit, as well as sampling locations in surrounding watersheds outside the area of potential operations.

Twenty-two stream sites were sampled twice, in early spring during high flow and late summer during low flow. Water samples were analyzed for major and trace elements, dissolved organic carbon (DOC), O and H isotopes, and field parameters. Major and trace elements abundances and mineralogy of sediment samples were also determined. Water at a subset of nine sites was sampled monthly for the above constituents and for radioisotopes. Discharge was measured to calculate loading. Fourteen ponds were sampled quarterly for the same analytes.

Statistical tests were used to compare analyte concentrations in stream reaches upstream and downstream of the deposit to evaluate the effect of the undeveloped deposit on surface water quality. Geochemical data collected at the site will also be compared to publicly available data from elsewhere in the Appalachian Piedmont and other uranium deposits to test for anomalies at Coles Hill.

Surface waters in the vicinity of the deposit are circumneutral (pH 3.9–7.6) with low total dissolved solids (specific conductance 3–93 µS/cm). Radionuclides, including U, ^{226}Ra and ^{228}Ra, and Th species, gross alpha and beta radiation, and trace metals, including As, Ba, and Pb, are below EPA regulatory limits for drinking water.

Statistically significant differences in composition were observed among streams, in particular in small drainages flowing near the ore bodies relative to other streams studied. Compositions at individual sites vary over time but indicate no regular trend. Positive correlations between DOC and dissolved trace metals such as Fe, Al, U, Ba, and Pb suggest complexation of metals by organic ligands. Higher concentrations of total metals relative to dissolved reflect metal transport via suspended sediment.

Sedimentary evolution in the northern South China Sea since Oligocene and its responses to tectonics

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Introduction

The South China Sea (SCS), one of the largest marginal sea of the West Pacific, has complex geological structure, unique development mode and has been controled by the Eurasian plate, Pacific plate and Australia - the Indian plate interaction since the late Mesozoic. Its formation underwent continental rifting, separation and seafloor spreading[1]. The tectonic evolution has a close relationship with peripheral geological units and can be recorded by sedimentary strata. This work is try to reconstruct sedimentary evolution of the SCS and its response to tectonics since Oligocene based on a multi-proxies including a monomineralic quartz oxygen isotope (δ^{18}O), grain-size of isolated terrigenous materials， terrigenous mineral accumulation rate of sediment samples from Ocean Drilling Program (ODP) Site 1148 in the northern SCS.

Results and Conclusion

The results show that the sedimentary evolution of the northern SCS Basin could be divided into five stages: period of initial expansion (34～28.5), period of intense tectonic activity (28.5～23), period of reduced tectonic activity (23～16.5)，period of thermal subsidence (16.5～3.5) and period of Taiwan uplift (3.5 Ma to present). Terrigenous mineral composition and oxygen isotope values of quartz altered significantly between 28.5 Ma and 23 Ma during which provenance transition took place, corresponding to the most active period of the SCS since Oligocene. Sediments of the study area were mainly from southern source (presumptively from Palawan) during the early spreading period of the SCS. With the extensive spreading of the SCS, especially when the spreading axis of the SCS jumped to south during 25～23 Ma, Palawan continental block moved away from the study site, while northern sources did not set up as Tibetan Plateau uplift had not spread to Yunnan-Guizhou Plateau, so that, terrigenous mass accumu-lation rate was very low. Later owing to the rapid uplift of Qinghai-Tibet Plateau, rivers such as Pearl River developed gradually, so did the headward erosion, as a result, South Mainland of China turned to be the main source of ODP Site 1148, and in the meantime the northern SCS converted to distal deposition. While the hiatus of ODP Site 1148 in the late Oligocene resulted from the lack of terrigenous materials supply, sea level rise and relatively stronger currents during the source transformation. With uplift and development of Taiwan island, it turned to be the major sediment provenance of the study area since 3.5 Ma.

[1] Li (2008) Evolution of China's marginal seas and its effect of natural resources. Beijing: Ocean Press (in Chinese), 228-240.