Sources of arsenic in groundwater based on geological and hydrogeochemical properties of an arid/semi-arid area in Yinchuan Plain, China

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Yinchuan Plain is a newly discovered high-arsenic groundwater area in the Yellow River Basin, China, with an arsenic range of 9µg/L in groundwater. 81 water samples were collected for chemical analysis along the direction from westren Helan Mountain to the central plains, The hydrochemical types gradually change from HCO_3, SO_4-HCO_3 types to HCO_3-Cl and Cl-HCO_3 types. High arsenic groundwater is mainly distributed in the Yellow River floodplain of eastern Helan country and subsidence center area of western Pingluo country, within the depth of 40m in phreatic water.

Arsenic was detected in rocks from Helan Mountains in varying degrees: arsenic in sedimentary rocks, which were significantly influenced by weathering, such as mudstone, sandstone and shale, was respectively 6.5mg/kg, 2.5mg/kg and 5.9mg/kg. Surface water, groundwater and wind transported arsenic in rocks to the plain. The coal-bearing strata in Helan Mountains and arsenic rocks are the main native sources of high arsenic environment in the study area. Analysis results of borehole sediments showed that high arsenic layers appeared in the depths of 18m, 41m and 92m below the surface. Limnetic facies sediments in lacustrine plain were the other essential source of groundwater arsenic. In addition, human activities have accelerated migration and enrichment of arsenic into groundwater.

A Phanerozoic CO_2 history driven by tectonics

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Our understanding of the geological regulation of the carbon cycle has been deeply influenced by the contribution of Bob Berner with his well-known model GEOCARB. Here, we will present a fundamentally different carbon cycle model that explicitly accounts for the effect of the paleogeography using physically based climate simulations and using 22 continental configurations spanning the whole Phanerozoic. We will show that several key features of the Phanerozoic climate can be simply explained by the modulation of the carbon cycle by continental drift. In particular, the continental drift may have strongly impacted the runoff intensity as well as the weathering flux during the transition from the hot Early Cambrian world to the colder Ordovician world. Another fascinating example is the large atmospheric CO2 decrease simulated during the Triassic owing to the northward drift of Pangea exposing large continental area to humid sub-tropics and boosting continental weathering. Conversely, our model fails to reproduce the climatic trend of the last 100 Ma. This is due to the highly dispersed continental configurations of the last 100 Ma that optimize the consumption of CO2 through continental weathering. This discrepancy may be reduced if we account for a larger influence of the Earth degassing flux on the atmospheric CO2 evolution, which could come from the increase contribution of the pelagic component on the oceanic crust on the global carbonate flux and from the many sub-marine LIPs occurring during the Late Cretaceous.

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DOI: 10.1180/minmag.2013.077.5.4