The isotopic and chemical characteristics of groundwater from Shihongtan uranium deposit and its surrounding area

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Isotopic and Chemical Characteristics of Groundwater

Hydrogeochemical study shows that the groundwater from Shihongtan uranium deposit is classified as the $Cl{\cdot}SO_4$-Na type water which is highly mineralized with TDS ranging from 8g/L to 12g/L. For the high TDS, high Ca^{2+} and SO_4^{2-} concentration, the calcite and gypsum in the groundwaters are over saturated. The δD and $\delta^{18}O$ values of the groundwater are in the range of -85.5 ‰ to -20.8‰ and -9.3‰ to -7.9‰ respectively [1]. The water from the surrounding area of this deposit is much less salinity than those from the deposit area. Its TDS ranges from 0.2 to 1.7 g/L. The δD values are in the range of -56 to 60 ‰ and the$\delta^{18}O$ values are in the range of -8.7 to 9.2‰.

Discussion of Results

The waters from the deposit area have significant difference of chemical properties from the waters from its surrounding area. High TDS is one of the main characteristics for the groundwater in this uranium deposit area. The exceeding evaporation does great contribute to the high ionic content for the groundwater in the area.

Stable isotopes of $\delta^{18}O$ and δD are used to trace and determine the origin and movement of groundwater. All waters samples both in Shihongtan uranium deposit area and its surrounding area follow a local meteoric water line, indicating that the waters are of meteoric origin (come from melting of snows in mountains). We obtain the correlation line between altitude and isotopic composition of local precipitation in this area, defined as δD = -0.036H-7.46. According to this correlation, the recharge altitudes are calculated as around 1348m~1460m for the groundwater in the surrounding area of this deposit.

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Multistage and heterogeneous uplift of the Tibetan Plateau implicated by the multi-episode post-collision lava

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Uplifting history of the Tibetan Plateau since continental collision between the India and Asia is still a contentious issue. It is generally believed that eruptions of post-collision lava were related to uplift of the plateau [1, 2], therefore their erupted times may be used to trace uplifting history. This study reports new-episode volcanic rocks in Qiangtang block of the central Tibetan Plateau, which erupted between 7-3Ma, and geochemical characteristics show that they were derived from a lower crust source.

Cenozoic post-collision lavas are widely distributed in several blocks of the Tibetan plateau. Combining published age data with our dating results, we find that eruption of the post-collision lava is discontinuous and heterogeneous in the plateau. The multi-episode magmatic activities occur in different blocks of the plateau, i.e., the earliest episode lava are only exposed in Qiangtang block of central Tibet. Then 26-10Ma and 18-10Ma lava occur in Lhasa block of south Tibet and Songpan-Ganzi block of north Tibet, respectively. Finally, 7-3Ma volcanic rocks erupted again in Qiangtang block of the central Tibet.

According to above temporal-spatial distribution of the post-collision lava, we suggest that the Tibetan plateau has experienced a discontinuous and heterogeneous uplift process. Earliest uplift took place in central Tibet (Qiangtang block) during 45-28Ma, then the elevation seems cessation in the central Tibet instead of south and north Tibet (Lhasa and Songpang-Ganzi blocks) started uplifting during 26-10Ma. It is in 7-3Ma that the central Tibetan plateau experienced new elevation. In addition, uplift of the Tibetan plateau may not be interpreted by a single tectonic model, it is more likely that the multi-geodynamic processes [3], e.g., break-off of the north-dipping subducted Indian slab in south [4] and the south-leaning of Euro-Asian plate [5], as well as the delamination of lower crust or lithosphere below the central Qiangtang [1], resulted in construction of the Tibetan plateau.

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