U-Pb dating of hydrothermal zircon and its implications for the metallogeny of the Donping gold deposit in North China

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The large Dongping gold deposit is located in the northern margin of the North China Craton, northwestern Hebei province, China. The ores are hosted by the Shuiquangou syenite complex and consist mainly of auriferous quartz veins and K-feldspar altered and silicified disseminated ores, both of which are characterized by low sulfide volumes, Te-rich and As-poor. U-Pb dating of zircons from the hornblende syenite on the western margin of the complex yields an age of crystallization of 400±3.5Ma. The close spatial relation of the gold mineralization with the syenite complex, and S, Si, and Pb isotope compositions of the ore-related mienrals, suggest that the ore deposit might be genetically related to the syenite complex. However, almost all of the published age of ore-formation vary in range of 157~177 Ma (^{40}Ar-^{39}Ar ages of hydrothermal K-feldspar[1-2]), which caused considerable controversy over the metallogeny of the Dongping gold deposit. Morphology, cathodoluminescence image and rare earth element concentrations of zircons from the first stage disseminated ore and grey auriferous quartz vein, and late stage low grade quartz vein suggest that the zircons are neocrystallized hydrothermal. The hydrothermal zircons from the disseminated ore and auriferous grey quartz vein are dated at 389±1.0Ma and 385±5.7Ma, respectively, which are close to the crystallization age of the syenite complex and might have been formed during post-magmatic hydrothermal processes. Considering the two type of ores are dominant parts of the ore deposit, we argue that the pervasive post-magmatic hydrothermal alteration is the main ore forming stage. U-Pb dating of the hydrothermal zircon from the low grade auriferous quartz vein yields an age of ~140Ma, which represents Yanshannian hydrothermal superimposition. Thus, the Dongping gold mine is a post-magmatic hydrothermal ore deposit with later stage hydrothermal overprint.

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Distribution of rare earth elements in marine Co-rich ferromanganese crusts of the South Atlantic

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Rare earth elements (REE) are of great geological, technological, economic and strategic interest. The increasing use of REE in high-tech products and the restrictive politics of some countries for commercialization of some REE raw products resulted in search for new deposits of these elements as well as the feasibility of unexplored reserves. One of the possible sources of REE are cobalt-rich seamount ferromanganese crusts. These are unconventional ores abundant in the deep ocean. Co-rich crusts are enriched in metals such as Co, Pt, REE, Ti, Ni, Tl, Te, Zr, W, Mo and Bi. The chemical and mineralogical characterization of Co-rich crusts occurrences has been carried out in several oceans [1,2]. In the South Atlantic, they are well known in the Rio Grande Seamount [3]. Ferruginous vernadite is a common phase in Co-rich crusts and moderate amounts of carbonate-fluorapatite (CFA) are found in thick crusts, as weel as low amounts of quartz and feldspar[4].

In this work, samples of cobalt-rich crusts from the Rio Grande Seamount, South Atlantic were chemically characterized. Trueness of analytical data was checked by analysis Co-rich seamount crust reference materials GSMC-1 and GSMC-3 [5]. The content of REE in the analysed samples is variable (ΣREY 320-3,100 mg/kg) and only 5-10% of these totals it is of heavy REE. Almost all samples show strong enrichment in Ce, as evidenced by PAAS normalized REE patterns. Such type of finding was previously interpreted as related to hydrogenetic Fe–Mn crusts [6]. Their formation is ascribed to the oxidative scavenging of Ce and its preferential removal from seawater by hydrous Fe–Mn oxides.

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