Proterozoic copper metallogenic framework and geochemistry steep zone in central Yunnan Province

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THE wildly horizontal and vertical chemical heterogeneties, which result from the inchoate core-mantle differentiation of the globe and the spatio-temporal difference of various regions in the globe, bring on the mantle and crust from different landmass and oceans with markedly elemental and isotopic signatures[1]. Wherefore these signatures could be used to differentiate the attribute from various landmass or oceans and recover the scent of kinematics and chemical geodynamics process. It is a quantificational method compared with the division by geotectonics facies and paleontologic fauna.

Based on the geochemistry mapping of elements and multi-isotopic systematics of rocks derived from mantle and crust and combined with the studies on geophysical tomographic image, four type geochemical provinces can be distinguished[1]. They are: (i) the Pacific (such as N-Pacific, N-Atlantic, the west of N-America and Jiamusi, Central Mongolia, Liaojiaobo, N-Xinjiang, South Gobi) where the lead isotopic data diagnostically inosculate to the NHRL; (ii) the India-East Gondwana (such as Indian Ocean, the south of S-Atlantic, India, Cathaysia, W-Australia, South Africa) with characteristics of DUPAL abnormity (high μ, $^{208}Pb/^{204}Pb$ and $^{87}Sr/^{86}Sr$); (iii) the West Gondwana (such as S-Pacific, Central S-Atlantic, Central Africa, S-America, Antarctica and E-Australia) with high $^{206}Pb/^{204}Pb$ and μ; (iv) the Laurasia (such as Siberia, Europe, Greenland, N-China, China-Korea, Xing'an and Tarim) with low $^{206}Pb/^{204}Pb$ and μ same as the primitive mantle. The studies on multi-isotopic systematics of rocks derived from mantle and crust show that there exist geochemical steep zones in the boundaries of the blocks (isotopic provinces). For example, the Australia-Antarctic Discordance (ADD) geochemical steep zone approximately in the S-N direction[2] is the boundary between the Indian Ocean and Pacific isotopic provinces, and South China-Yangtze geochemical steep zone is the boundary between South China and Yangtze isotopic provinces[1].

In central Yunnan Province, the boundary of South China-Yangtze geochemical steep zone can be distinguished by the lead isotopic mapping where the eigenvalues V_1 and V_2 are 53 ± 1 and 40 ± 1 respectively[3]. There emerges the turning point of the geochemical steep zone nearby the Gejiu area. This region is divided into two parts by the South China-Yangtze geochemical steep zone: the central Yunnan belt in the N-S direction belongs to the Yangtze block and the Red River belt in the N-W direction belongs to the Huaxia block.

The eigenvalues V_1 of the copper ores from the Dongchuan and Yimen copper deposits are almost less than 53[4], and those from Dahongshan, Chahe and Jinping copper deposits are almost greater than 111[5]. The lead isotopic features indicate various metallogenic backgrounds.

The U-Pb ages of 1 765 and 1 685 Ma yielded by the zircons from the volcanic rocks of the Yinmin Formation, the Pb-Pb ages of (1 716 ± 56) Ma and (1 607 ± 128) Ma yielded respectively by the dolomites of the Luoxue Formation and the carbonaceous slates of the Heishan Formation[4], indicate that the Fe-Cu-bearing volcanic-sedimentary rock series of the Kunyang Group should be the parallel strata of different blocks with those from the Dahongshan Group but not one-piece connection.

The Nd isotopic features also show the difference of the two parts. The $^{143}Nd/^{144}Nd$ ratios of the mafic volcanic rocks from the Jinping and Dahongshan are entirely greater than 0.512 00[5] and the majority of those from Dongchuan are less than 0.512 00[1)]. The Nd model ages of the mafic volcanic rocks from the Jinping and Dahongshan are 1.0—2.0 Ga and those from Dongchuan are 2.0—3.0 Ga. The Nd

1) Duan, J. R., Liu, J. S., Hu, X. Z., Study on metallogenic prognosis and modification of the 1:50 000 geologic map from Dongchuan copper deposits, Yunnan, Changsha: Central South University of Technology, 1994, 185—195.

isotopic features also indicate that the Dahongshan Group and the Kunyang Group are not one-piece connection.

The geophysical signature can image the difference of the two parts too. The data from the great section of Longling-Binchuan-Malong with 800 km extent show obvious difference of crust structures of the two parts[6]. The geochemical dividing line inosculates with the regional gravity anomaly.

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Epithermal gold deposits in China and potential assessment

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THE epithermal gold deposit (epi-gold) is one of the most important types in various gold deposits all over the world. The discovery of several superlarge deposits of this type around the circum-Pacific Rim during the 1980s, greatly stimulated the interest in searching for epi-golds in the world as well as in China. The epi-gold has become a major target in gold exploration in China during last two-decade "Golden Rush". The discovery of the Zijinshan Cu (Au) deposit in SE China and the Axi and other Au deposits in NW China is the significant success in gold prospecting in this field. The author suggested that it is the time to do an overview and the potential assessment of epi-golds in China[1].

Some people are holding an optimistic idea on this topic mainly based on the following considerations: (ⅰ) as a host rock, the subaerial volcanic rocks of Mesozoic are widespread in East China; (ⅱ) in its opposite side of the Pacific Ocean, i.e. the West America, there are abundant epi-golds and some of them are with giant reserves, although most of them are of Tertiary predominantly; (ⅲ) in the neighboring Russia (Siberia), the same Mesozoic volcanism generated several superlarge epi-golds and polymetallic Au deposits such as Baley and Darason; (ⅳ) both East Taiwan and North Xinjiang are the island arcs of Cenozoic and Late Paleozoic, respectively, favorable for exploration for epi-golds.

In this note, the characteristics of epi-golds in China is briefly summarized, and the comparisons of Sino-America and Sino-Russia have been made mainly in the tectonic settings, the lithology of volcanism and basement and the preservative condition of deposits based on the data available. Finally, the author is giving a rather conservative potential evaluation for further discussion.

1 Temporal and spatial distribution of epithermal gold deposits in China

(ⅰ) Ages of epi-golds in China. There is no reliable evidence for the occurrence of epi-golds older than Paleozoic in China. The formation ages of epi-golds in China can be clearly divided into three episodes: ⅰ) Cenozoic——as Chinkuashih in NE Taiwan[2] and Lianghe in West Yunnan; ⅱ) Mesozoic——almost all epi-golds in East China[3,4]; and ⅲ) Late Paleozoic——most epi-golds in North Xinjiang[5].