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Geochemical Anomaly Zones and Mineralization Concentrated Areas in China

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Abstract *:With the accumulation of detailed regional geochemical data, geochemical block concept is gradually revealling its limitations. On China 1:200000 stream sediment geochemical maps, we can find, gold, silver, copper, molybdenum, lead and zinc anomalies area, usually from a few km^2, to several tens of km^2, the maximum does not exceed a few hundred km^2. Accordingly it is difficult to delineate typical sense geochemical blocks. Large and small in all sizes geochemical anomalies are embedded in the generalized background field，this field form by average background with negative anomalies. they appeared the spread state of microscopic disorder macro regulation. For this reason, the author proposed the concept of geochemical anomalies dense bands, attempts to offset the defect of geochemical block concept. On China geochemical anomaly maps, according to the principle of within the region the maximum density anomaly and outside the region the minimum density anomaly, we can direct delineates anomalies dense bands. Gold, silver, copper, molybdenum, lead and zinc elements geochemical anomalies are basically unanimous, mainly distributed in the following areas: Great Hinggan, Little Hinggan, Hulunbuir, Qianshan-Zhangguangcailing, Inner Mongolia Plateau, Yinshan-Yanshan, Altai-Beishan, Ala mountains, Tianshan – Qilian - Qinling, Dabie mountain, Jiaodong peninsula, Taishan - Yimeng-Yuntaishan, Qinghai Nanshan, Kunlunshan–Bayanhar-Daxueshan, Kailash - Nyainqêntanglha, Xuefengshan, Nanling - Wuyishan, Yunnan-Guizhou plateau, Ailaoshan, Hainan island etc. There are great differences in this bands with previous geochemical province (block) delineation results. The zonal distribution area consistent with the plate suture zones, collison orogenic belts and volcanic island chains and other tectonic magmatic belts. Besides, consistent with the distribution of the main mineralization concentrated area. Distribution characteristics of geochemical anomalies and mineral deposit focus area, it reveals the close dependence relations between mineralization and crustal evolution, tectonization and crust-mantle mutual interaction.*

Keywords*: Geochemical block; Geochemical anomaly zones; Gold and silver polymetallic deposit; mineralization concentrated area; China Mainland*

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Based on the predictive purposes of super-large deposits and mine centralized area, according to the uneven distribution of abundance of surface crustal elements, scholars put forward the concept of geochemical metallogenic province and geochemical blocks, from the perspective of metal supply quantity, better explains the cause problem of giant deposits that it can not be explained by the mineralization process, environment and conditions. With the constantly deepening of geochemical research work, this concept will be constantly refined.

I. Introduction:

The Origin and Defects of the Concept of Geochemical Blocks

A large number of research results show that, the distribution of geochemical anomalies reliable existed that it reflecting comprehensive results of the initial distribution of the Earth's surface elements and the post-superimposed mineralization, but its distribution range, spatial forms, concentration scale, has a significant difference due to the sampling medium and the mapping scale.

Hawkes has definited the geochemical province is a relatively large range of rock assemblages, that its chemical composition is significantly different from the crustal abundance, within its scope can provide an economically significant initial exploration target[1]. Doe proposed the geochemical block concept, explains it is large rock blocks with a high content of certain or some elements, can provide material sources for the formation of deposits[2]. In 1994, Xie proposed, the huge metal supply in mineralization, can be represented by certain geochemical blocks in the crust. Xie proposed, South China tungsten's huge geochemical blocks, through the long and complex various geological effects gradually concentrated, finally forms huge deposits. same year, Xie has summarized the concept of geochemical blocks: on earth, the huge rock mass with one or some elements relatively high content, is one of the manifestations of nonuniformity in the process of regional crust

formation and evolution. They provide the necessary material basis for the formation of large or even extra large deposits[3].

Wang prepared the Chinese gold geochemical province distribution map, a total of 11 gold geochemical provinces are divided in nationwide[4]. Xie has found a more extensive geochemical model: regional anomalies, geochemical provinces, geochemical huge provinces and geochemical domains. We can use the dissect maps and pedigree trees of internal structure of metal elements, to select the most promising target for next step exploration[5]. Chi has used petrochemical element abundance to study geochemical blocks, to research the differences in the elements composition[6]. Gong has studied the relation of distribution of gold geochemical blocks and gold deposits in Hebei Province [7]. Xie et al put forward, The geochemical block concept has the capacity to change mineral exploration strategy and methodology in China, providing a powerful tool for global mineral potential assessment[8].According to the comparison between the geochemical blocks and the ore deposits in the eastern Tianshan Mountains, Wang think, all known mine-concentration areas are located within the geochemical blocks, but the presence of geochemical blocks, not necessarily the existence of mine concentration areas. It is presumed that there may be potential mineralized areas in the geochemical blocks [9]. Using rock geochemical data, Shi has delineated the geochemical blocks of lead and zinc in Hebei Province. The spatial relationship shape is very complex that between large medium - sized deposits and the geochemical blocks, which is more obvious by the control of several magmatic enrichment zones [10].

Liu pointed out, the formation of copper geochemical blocks may be related to the high background values of the rocks, the ore concentrates or the associated elements deposits. The supply of huge amounts of ore-forming material is only necessary condition to form large, super-large deposits, but each geochemical block does not necessarily have a corresponding mineralized area[11].

Using the national 1: 200,000 regional geochemical scanning high quality analysis data, Wang has extracted the average of each 1: 50,000 map sheet-systems，by 2.5 ng / g as the anomaly threshold, delineated the Chinese gold geochemical provinces, he found multi - layers set geochemical model pedigrees in the geochemical provinces relate to gold deposits[12].

The above review is not difficult to find, the researchers delineated the geochemical blocks used dataset is an average value in the range of 400 km^2 or more, this will undoubtedly be due to stream sediment mineralization elements especially high content where individual deposits, artificially elevated content mean, thus increasing the range of anomaly distribution, resulting in unrealistic results. In addition, most of the researchers only gold as an example, for other mineral elements are rarely involved. In terms of the spatial distribution of geochemical blocks and deposits, its conclusion is not comprehensive, such as: where there is no geochemical block, the same can be formed large-scale gold deposits, and the relationship between the copper geochemical blocks and the known copper deposits is not close, that is, within the geochemical block is often no large copper deposits, large-scale geochemical anomalies are rarely formed in the range of large-scale copper deposits; lead-zinc deposits are mostly distributed in the edge transition zones of rock geochemical blocks; Silver ore deposits are closely related to the geochemical high background distribution of intrusive rocks.

II. From Geochemical Blocks to Geochemical Anomalies Concentrated Zones

2.1 Data Source

From 2007 to 2015, National mineral resources potential evaluation project, based on the point location data of stream sediment in 4km^2, has compiled series maps of geochemical and geochemical anomalies of the provinces, regions and the country in China. China Geological Survey Bureau Development Research Center project team, based on the 1: 200,000 elemental geochemical anomaly maps of Provincial, municipal and autonomous regions, has compiled the geochemical anomaly maps of single element in six regions, on the National Geographic Data System, projected to become a national map projection by geographical coordinates converted.

On the 1: 200,000 national geochemical maps, geochemical anomalies from nkm^2 to n × 10km^2, rarely more than 500 km^2, these anomalies are embedded in the general background field of the mean background and negative anomalies, local seemingly no rules, macro-distribution is showing some regularity. In these maps, the forefathers so-called large-scale high background geochemical blocks were disintegrated, the anomalies spatial distribution is characterized by a relatively dense distribution concentrated zones of geochemical anomalies. For this reason, author put forward to replace the original geochemical block concept with the concept of geochemical anomaly dense zones, which will be more important for the role of regional metallogenic prediction.

2.2 Mapping Method

In the geographic information system MapGIS operating platform, according to this principle-the distribution of geochemical anomalies in the region internal is greatest(usually the anomaly areas divided by the background areas + negative anomaly areas ratio more than 50%), the exterior, geochemical anomaly distribution density is the smallest(even not)，artificially handcraft delineate the geochemical anomaly dense

distribution zones，and to name them by important mountains and rivers in the distribution range.

III. Distribution Characteristics of Geochemical Anomalies Concentrated Zones in China

The author has used China gold, silver, copper, molybdenum and lead and zinc 6 kinds of elements as the object, try to study the distribution characteristics of geochemical anomalies concentrated zones.

The author has delineated geochemical anomaly concentrated zones : Gold22 places, Silver20 places, copper24 places, molybdenum30 places, lead21 places and Zinc 26 places.

Gold geochemical anomaly concentration zones: Greater Hinggan mountains north section, Little Hinggan mountain, Hulunbuir, Greater Hinggan south section, Qianshan - Zhangguangcai, Inner Mongolia plateau, Yinshan -Yanshan, Mount Altai - Beishan, ALashan, Tianshan - Qilian - Qinling, Dabie mountains, Jiaodong peninsula, Mount Tai - Yuntai mountain, South Tianshan mountain, Qinghai Nanshan, Kunlun mountain - Bayankera mountain - Daxue mountain, Gangdisê mountains - Nyainqentanglha mountain, Xuefeng mountain, Nanling - Wuyi mountain, Yungui plateau, Ailaoshan, Hainan island.

Silver Geochemical abnormal concentration zones: Greater Hinggan mountains north section, Little Hinggan Mountains, Hulunbuir, Greater Hinggan south section, Qianshan- Zhangguangcai, Yinshan -Yanshan-Taihangshan, Jiaodong peninsula, Mount Tai-Yimeng mountain, Altay mountain, Beishan, ALaShan, Tianshan - Qilian - Qinling, Dabie mountains, South Tianshan mountain, Kunlun - Altun mountain, Nyainqentanglha -Hengduan mountain, Gangdisê mountain, Wulian peak, Ailaoshan mountain, Nanling - Wuyi mountain, Hainan island.

Copper geochemical anomaly concentration zones: West slope and east slope in North section of the great Hinggan, Little Hinggan, Hulunbuir, Greater Hinggan south section, Qianshan - Zhangguangcailing, Altay, ALaShan, Beishan, Alxa, Yinshan - Yanshan, Taihang mountain, Jiaodong peninsula, Mount Tai - Yimeng, Tianshan - Qilian mountain - Qinling, Qinghai nanshan, South Tianshan mountains, Kunlun mountain - Balyanlkalla mountain - Mount Tanglha, Gangdisê mountains middle, Ailaoshan – Emei , Yunnan-guizhou plateau, Middle and lower reaches of the Yangtze river, Nanling - Wuyi mountain, Hainan island.

Molybdenum geochemical anomaly concentration zones: Greater Hinggan mountains north section, Little Hinggan, Hulunbuir, Taiping hill, Huanglianggang, Qianshan mountain - Zhangguangcailing, Aaltay, Alashan, Colin crook tucker, Beishan, Alxa, Yinshan - Yanshan, south Tianshan mountain, west Kunlun mountains, east Kunlun mountain, Hoh Xil, Qilian mountain- Daban mountain, Qinghai nanshan, Mount Tanglha, Gangdisê mountains, Jiaodong peninsula, Mount Tai-Yimeng mountain, Xionger- Funiu, Qinling mountains - mount Wudang, Wushan, Wuling mountain, Nanling – Wuyi mountain, Ailaoshan, Mioaling, Hainan island.

Lead geochemical anomaly concentration zones: Greater Hinggan mountains north section, Little Hinggan, Hulunbuir, Greater Hinggan south section, Qianshan mountain - Zhangguangcailing, Aaltay, Alashan, Beishan, Kuluk tucker, Qilian mountain, Langshan, Liupanshan, Qinling - Xionger mountain, Mount Tai, Kunlun - Altun mountain, Nyainqentanglha mountain – Hengduanshan, Ailaoshan, Middle and lower reaches of the Yangtze river, Nanling – Wuyi mountain, Cenlaowang hill, Hainan island.

Zinc geochemical anomaly concentration zones : Erguna, East slope in North section of the great Hinggan, Little Hinggan, Laoyeling, Erlianhot Chagan aobao, Xilinhot – Huanglianggang, Qianshan –Longgang mountain,Yinshan-Taihang- Yanshan, Aaltay, Alashan, Boroconu. mountain, Bogurda mountain, Tianshan east section, Beishan, Qilian mountain, Kongur Mountain, Altun mountain, Tenasserim chain, Gangdise mountain east section, O nima Qingshan, Qinling - Xionger mountain, Jiuhua mountain, Xuefengshan, Nanling – Wuyi mountain, Yun-Gui plateau, Hainan island.

(1) Within one-third to one-fourth of the area, concentrated distribution more than 80% -90% whole country the geochemical anomalies; (2) China's gold, silver, copper, molybdenum, lead and zinc geochemical anomalies concentrated zones spatial distribution is basically congruous, suggesting that they follow a similar pattern of enrichment migration; (3) Geochemical anomaly zone is in very coincide with the giant linear structure of tectonic magmatic rock belts, orogenic belts, plate suture zones and volcanic island arc, the main direction is the northwest direction, next by the northeast and east - west directions, it is the result of Yanshan movement and Variscan orogeny; (4) The geochemical anomalies of gold, silver, molybdenum, lead and zinc are in very coincide with the concentration area of deposits, while the copper corresponding relationship slightly worse, may indicate vary that the effectiveness of different geochemical exploration methods; (5) Distribution characteristics of geochemical anomalies and ore deposits, revealing the close dependence between mineralization and crustal evolution, tectonic movement and crust-mantle mutual interaction.

IV. The Results Discussed

The theory of block tectonics comes China the evolution of land and sea tectonics down to, as one demarcation, two front lines, three transformation formats, four conversion faults, five screens evolution history. China's land and sea tectonic framework is summarized as three horizontal and two vertical two triangles. Three

horizontal are three transverse distribution tectonic belts: A Tianshan - Yinshan - Yanshan, B Kunlun - Qinling - Dabie Mountains, C Nanling tectonic belt; Two vertical are D Daxinganling - Taihang mountains - Wuling hill cascade zone, E Helan mountain - Longmenshan north and south zone; Two triangles are: F Qaidam area surrounded by Aldjin-Qilian mountains, and G Songpan - Ganzi area. North China, Yangzi and south China block are separated by three horizontal; The two vertical bands gives the Tethys domain, the Pacific Ocean and its transition zone[13][14][15]. Zhang pointed out that in the three horizontal, two vertical, two triangular with the vicinity of the band, is concentrated areas of variety of metal deposits; In the stable area between binding zone, is the main target areas of oil and gas exploration [16][17].

Typical deposits in China show that：(1) distribution of surrounding rocks of basic-ultrabasic magmatic differentiation type Cr, Ni, V deposits, with the rock element enrichment coefficient sequence, there is a good correspondence, indicating that the ore-forming materials are mainly from the magmatic rocks themselves; ⑵Sedimentary rocks, metamorphic rocks, volcanic rocks, intermediate-acid intrusive rocks, between element enrichment coefficient series and the distribution of the mineral deposit surrounding rock, there is no close correspondence. Most of the surrounding rock is not enriched ore-forming elements of the corresponding deposits, while the enrichment of hydrothermal elemental composition H_2O, CO_2, S, Cl, Hg, F, As, Sb, Se and heat source element K, Na, U, Th, more closely with the gold and silver polymetallic mineralization.

The concept of geochemical block, its proposed is earlier, based on the information is rough. For a blank area on the earth, the very low density geochemical mapping, the concept has a certain guiding significance. However, for medium to large plotting scale geochemical scanning areas the application value of this concept is limited. The geochemical anomalies in these areas, we comprehensively analyze to combine with stratigraphic formation, magmatic activity and tectonic setting, such，its prospecting effect is better.

In short, the concept of geochemical blocks put forward, over the past half century, its theoretical value is much higher than the practical significance. With the accumulation of more detailed regional geochemical data, it was found that, spatially continual distributed geochemical anomalies are rarely able to exceed a few hundred km^2, but China's 1: 200 000 stream sediment geochemical anomalies throughout the territory, showing the dense distribution characteristics along the tectonic magmatic zones, at the same time with the mine centralized areas corresponding to each other. The results of this research, for the regional metallogenic prediction and prospecting exploration and deployment, will give play to great guiding function.

References

[1]. Hawkes H E, Webbs J S .1962.Geochemistry in mineral exploration [M].New York: Harper & Row .10-415.
[2]. Doe. B. R. 1991. Source rock and the genesis of metallic mineral deposits [J]. Global Tectonics and Metallogeny, 4(1-2):13-19.
[3]. Xie Xue-Jin. 1995. Looking giant deposit with new ideas and new technology [J]. Scientific Chinese. 5: p.e14-16.
[4]. Wang Xueqiu. 2000. Giant deposits and large - scale ore deposits exploration geochemistry [J]. Deposit geology, 19 (1) : p. e 76-87
[5]. Xie Xuejin ,Liu Dawen, Xiang Yunchuan, Yan Guangsheng. 2002. Geochemical block- Conceptual and methodological development [J]. China Geology, 29 (3): p. e 225-228
[6]. Chi Qinghua. 2002. Applicats rock chemical element abundance sresearch geochemical blocks [J]. Geology and Exploration. 38 Supplement, p. e 164-167.
[7]. Gong Jinzhong,Yang Chun. 2004. Gold ore source beds and geochemical blocks of Hebei. Gold Geology, 10(4): p. e 55-60
[8]. Xuejing Xie, Dawen Liu, Yunchuan Xiang, et al.2004.Geochemical blocks for predicting large ore deposits-concept and methodology [J]. Journal of Geochemical Exploration , 84 (2): p.e 77-91
[9]. DOI: 10.1016/j.gexplo.2004.03.004
[10]. Wang Xueqiu,Sheng Wujun,Zhang Bimin et al. 2007. Relationship of geochemical block and large ore districts: examples from Eastern Tianshan metallogenic belt.China. Earth Science Frontiers, 14(5): p. e 116-123
[11]. Shi Shujuan, Gong Jinzhong, Zhang Jie. 2010.Lead-zinc source beds and geochemical blocks in Hebei Province [J].Mineral Deposits, 29(2): p. e 276-282
[12]. Liu Xuemei, Wang Xueqiu, Xu Shanfa et al. 2012. Relationship of geochemical block and metallogenic provinces in South China Continent. Earth Science Frontiers, 19(3): p. e 59-69
[13]. Wang Xueqiu,Xu Shanfa,Chi Qinghua et al. 2013. Gold geochemical Provinces in China: A micro-and Nano-scale formation mechanism. Acta Geologica Sinica, 87(1): p. e 1-7
[14]. Liu Guangding, Hao Tianyou, Liu Yike. 1997.China 's geotectonic macro - frame and its relationship with mineral resources. scientific briefing, 42(2):113-118
[15]. Liu Guang-ding, Hao Tian-qi.1998.China's Geological Environment and Concealed Deposits, Chinese Journal of Geophysics, 41 (2):182-188
[16]. Liu Guangding. 2007. The dynamic evolution of tectonic framework in China, Earth Science Front, 03: 39-46. doi:10.3321
[17]. Zhang Xunhua, Meng Xiangjun.2009.Han Bo. Block and block structure theory [J].Marine geology and Quaternary geology, 10, 29(5), 59-64
[18]. Zhang Xun-hua,Guo Xing-wei. 2014. The geotectonic system of block structure theory. Chinese Journal of Geophysics, 12: 3861-3868

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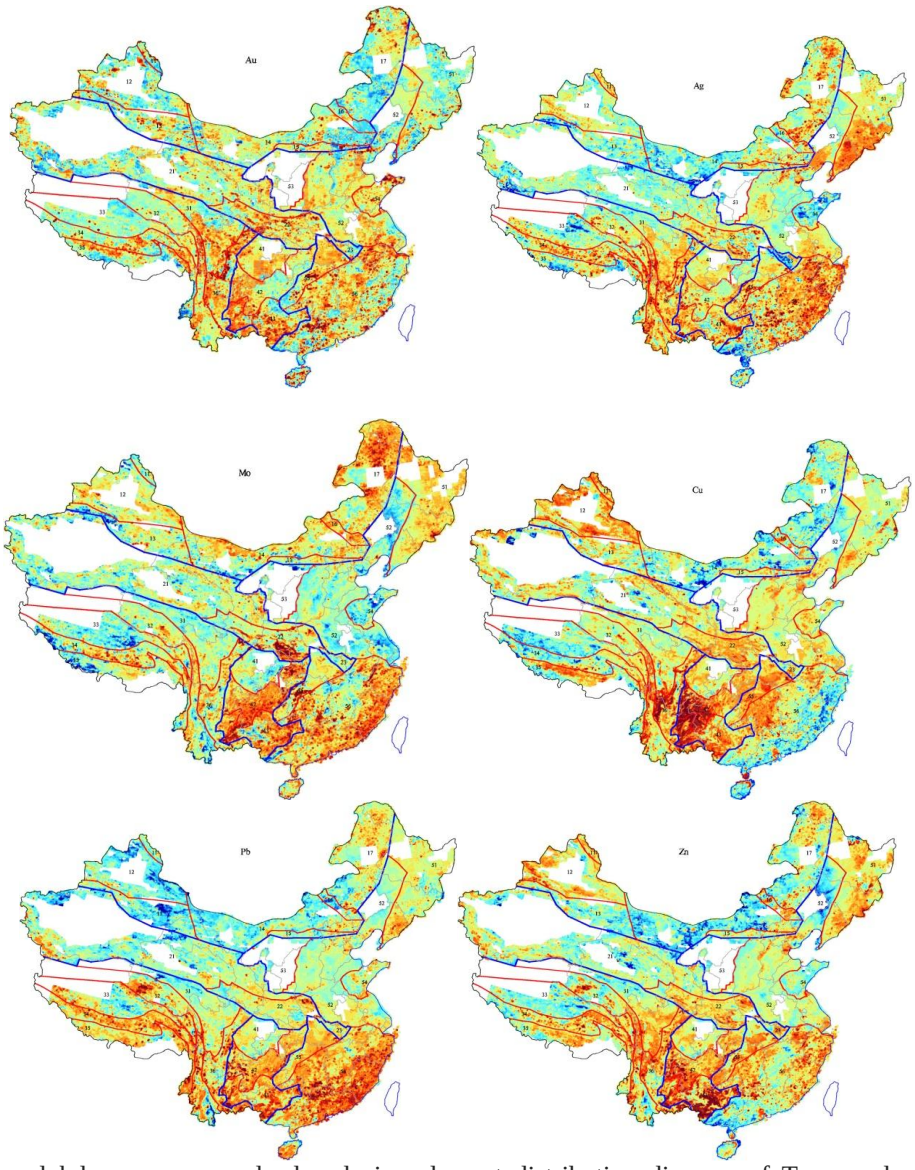
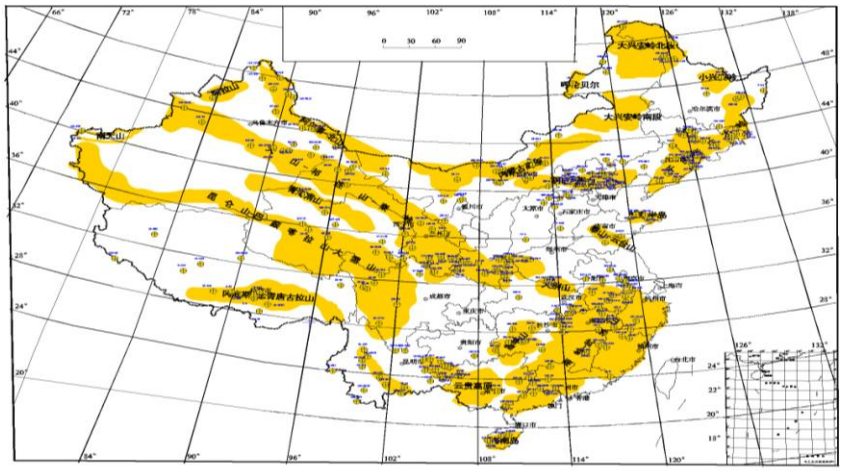
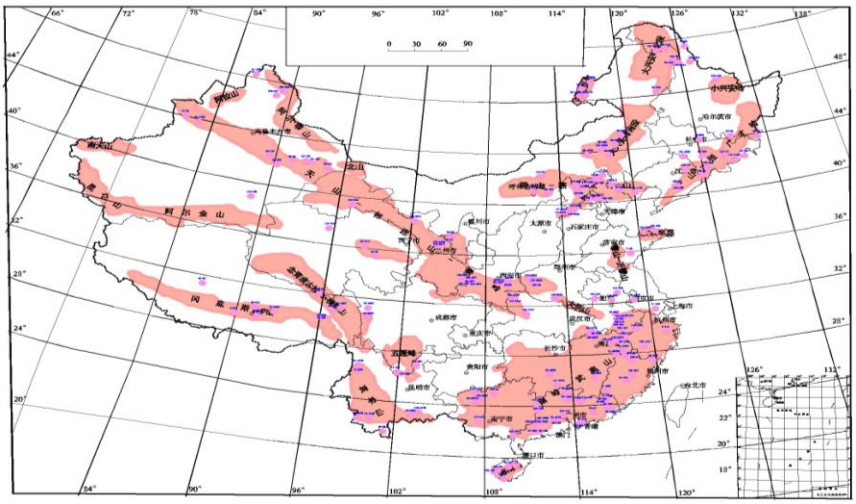


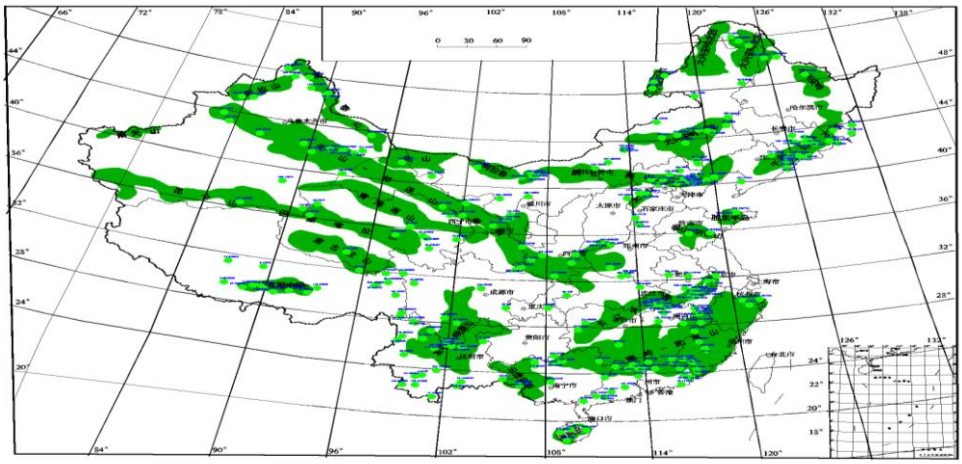
Gold, silver, molybdenum, copper, lead and zinc element distribution diagram of Two grades geochemical provinces in China (Development Research Center of China Geological Survey Bureau, 2013)



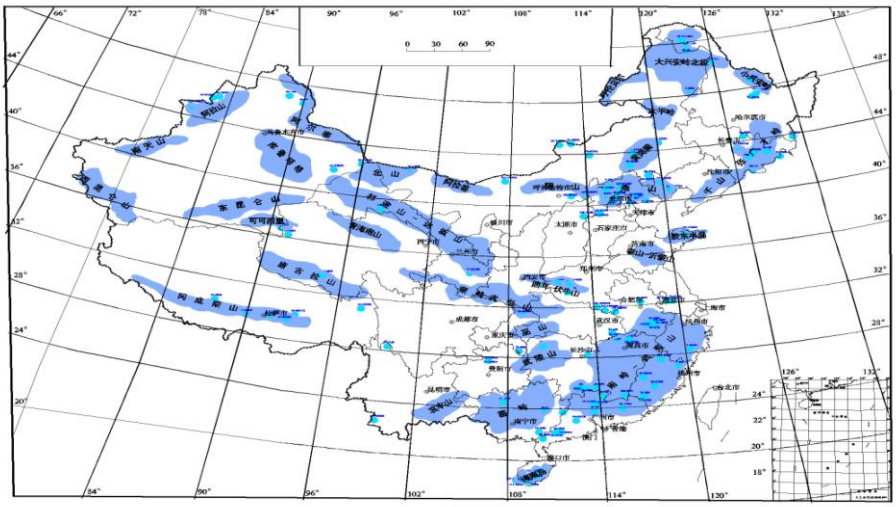
District map of gold elements geochemical anomaly zones and gold deposits concentration area in Chinese



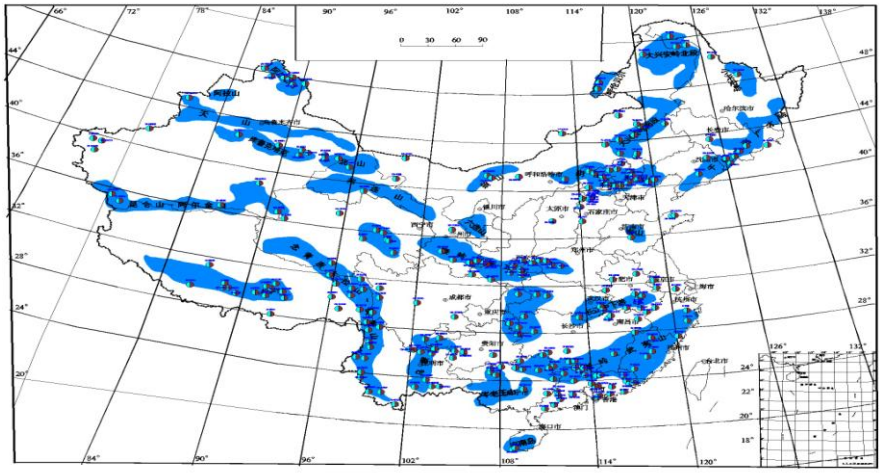
District map of silver elements geochemical anomaly zones and silver deposits concentration area in Chinese



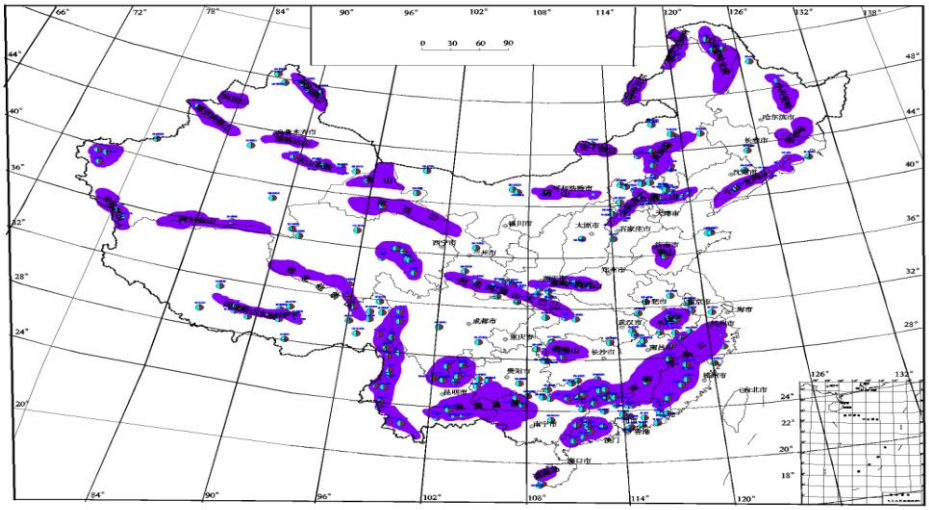
District map of copper elements geochemical anomaly zones and copper deposits concentration area in Chinese



District map of molybdenum elements geochemical anomaly zones and molybdenum deposits concentration area in Chinese



District map of lead elements geochemical anomaly zones and lead deposits concentration area in Chinese



District map of Zinc elements geochemical anomaly zones and Zinc Deposits concentration area in Chinese

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