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# Comparative Study and Spatial-Temporal Distribution of Regolith and Rock Geochemical Data from Xingmeng - North China

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## 1 Introduction

Geochemical mapping at national and continental scales continues to present challenges worldwide due to variations in geologic and geotectonic units. Use of the proper sampling media can provide rich information on the geochemical compositions of different geological units as well as geochemical responses to climate change, weathering and various types of mineralization.

The abroad study on geochemical transect, is mainly for the North American continent scale geochemical transect research across Canada and the United States (Smith et al., 2008; Drew et al., 2010). However, China is still at the primary systematically studying the content and spatial distribution of geochemical elements on the national or continent scale, especially in the area of the geochemical transect.

Different from the China geochemical baseline, which of study rang is a nationwide two-dimension planar, however, the study area of the geochemical transect is a national or continent one-dimension transect. The sampling density of the latter is high(1~4 km/site) along a linear sampling route to collecting regolith and rock samples, through which demonstrating the spatial distribution relationships between element content of sediments or rocks and the various factors, for example, geology, geography, climate et al.

In order to study the regional geochemical composition and lateral spatial variation of the geochemical elements, a national-scale geochemical transect across the Xingmeng Orogenic Belt and the North China Craton has been completed as a part of the China Geochemical Baselines Project (Wang et al., 2015). Its purpose is to systematically document the concentration and spatial variations of chemical elements in the surface materials that cross on different geotectonic units. the results can be used in various geoscience fields. The significance of geochemical baseline is to establish the scale plate of content and spatial variation of the elements in the surface sediments of China (Wang et al, 2010), which is very important to understand the status of resources distribution, environment change and land use in China, etc.

There are three transects in the China Geochemical Baselines Project. The Xingmeng orogenic belt and North China Craton geochemical transect has been chosen as the research object for its particular plate-tectonic setting and geology time features. The Xingmeng Orogenic Belt is located between the Siberian craton and the North China craton. Its dominant lithologies are Hercynian granite, granodiorite, pyroclastic rocks, Neogene sandstones or aeolian sand, and Quaternary sediments. The North China Craton main lithologies are Yanshanian granite, granodiorite, pyroclastic rocks, Archean gneiss, Neogene sandstones and quaternary sediments.

In this paper, the rock samples were classified, and the characteristics of selected element concentrations in different lithology and geological age are analyzed, especially the characteristics of $SiO_2$, Au in magmatic rocks and rare earth elements in granite were discussed.

## 2 Methods

### 2.1 Sampling and Analysis

Regolith and rock samples were collected for 550 and 1309 pieces in high density of 1-4 km(based on outcropping bedrock) along the transect across the Xingmeng Orogenic Belt - North China Craton and 76

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elements concentrations were determined.. The samples were subjected to laboratory analyses for 76 elements using ICP-MS, XRF, and ICP-OES combined with other methods, described in more detail by Wang (2012) and Wang et al. (2015).

**2.2 Data Processing and Mapping**

Data of statistical analyses of principal components, ore-forming elements and REE for regolith samples were based on tectonic units, geographical landscape, soil types and rainfall units, and for rock samples were based on rock types and geologic age units. An average value was calculated from each 1:50 000 map sheet, and spatial distribution of selected elements concentrations is plotted in figures.

## Results and Discussion

The comparison of $SiO_2$, $Al_2O_3$, illustrates than the regolith mineral composition is one of the most important factors affecting its concentrations; The enrichment of CaO and MgO is closely related to carbonate rocks; Rainfall significantly affects on the enrichment of $Na_2O$ and $K_2O$ in regolith, though there exist slight differences. The concentration and spatial distribution of the major elements in regolith are not only affected by succession of the bedrock, but also by the complex factors like, weathering, climate and geochemical properties. The change of $SiO_2$ concentration demonstrates the trend of acid evolution in the upper crust, of which concentration is the highest in Hercynian magmatic rocks. The concentrations of $H_2O^+$ is generally low, besides in the carbonate rock and local quaternary area. The value of pH reflects the characteristics of alkaline sediments characteristic in the north China.

The enrichment of Au is closely related to the Archean Proterozoic crystalline basement, and the enrichment coefficient of Au in the Yanshan Orogenic Belt is obviously higher than that in the Luxi Block, which is consistent with the distribution of Au deposits. Ag and Cu enrichment coefficient curves are very similar, moreover Pb and Zn is almost completely consistent for their minerals closely related existence. The enrichment coefficient of W is a perfect interpretation of its enrichment in granite, which also shows a high concentrations in the plain sediments, indicating that the provenance may be affected by the Yanshan Orogenic Belt and the Luxi Block. Ti corresponds well with the distribution of basic - ultrabasic rocks, and the abnormal enrichment of V in sediments of northern Jiangsu may be related to the Luxi Block.

The spatial distribution of the concentration of REE in regolith and rocks indicates that the source region determines the overall difference of REE in different tectonic units, but the supergene conditions also play an important role in local area. The concentration difference of REE in different granitoids or tectonic units is larger than that in the geological age; There are also differences in the same kind of granite in different geological times, indicating the granitoids formation in different magmatic geological process.

The strong query function between spatial data and attribution data of geographic information system, help to better manage the geochemical sample data, provide basis for further data mining and data application in basic geology, mineral resources prediction and agricultural production activities.

## Conclusion

Above all, the results highlight that the influence of the surface environment on the concentration and distribution of elements is complex and important in the complex earth's surface system, such as the geographical landscape, climatic factors, etc. The biological action, human industrial or agricultural activities on soil concentration should be paid more attention, which complex mechanism is worth studying deeply, anyway, Geographic Information System(GIS) can be useful.

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